

ELECTRIC SYSTEM

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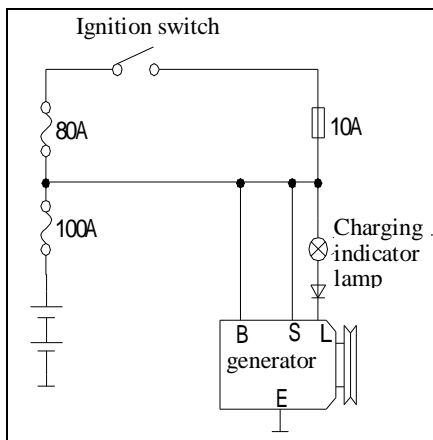
Power Supply, Fault Diagnosis and Maintenance

1 Common Troubles of Battery in Use

Common troubles of battery include plate sulphation, self discharge, plate active material scaling off, plate short circuit, etc. Trouble phenomenon, causes, precautions and remedy are given in the following Table.

S/N	Troubles	Phenomena of Trouble	Cause of Trouble	Precautions	Remedy
1	Plate sulphation	<ul style="list-style-type: none"> * There are white frost-like substances on plate surface. * Battery internal resistance is increased, capacity is decreased. * When discharging, voltage rapidly drops, starting is difficult. * When charging, voltage and temperature rapidly rise, and electrolyte density rises slowly. * Boiling phenomenon happens too early. 	<ul style="list-style-type: none"> * Battery is stored for long time at state of insufficient charge or state of discharge, white coarse crystals of lead sulfate are formed when temperature changes. * Electrolyte level is too low, upper part of plate is in contact with air and become oxidized. The contact of oxidized plate with electrolyte produces coarse crystals of lead sulfate. 	<ul style="list-style-type: none"> * Battery should be stored at full charged state. * Battery not used or in use should be supplementary charged periodically. * The level of electrolyte should be 10~15mm higher than plate. 	<ul style="list-style-type: none"> * Desulfurizing charge
2	Self discharge	<ul style="list-style-type: none"> * The phenomenon of automatic loss of capacity of fully charged battery not used is referred to as self discharging * The amount of discharge exceeding 20% within each day and night is considered as a problem of self discharging 	<ul style="list-style-type: none"> * There are impurities in electrolyte. * Battery surface is not clean. * Electrolyte density is too high. * Active material coming off plate shorts circuit positive and negative plates * Stibium in plate grid forms local cell 	<ul style="list-style-type: none"> * Prepare electrolyte by using pure sulfuric acid and distilled water * Vessel for preparing electrolyte must be glass or plastic * After charging, put on electrolyte filling hole cap * Keep battery surface clean 	<ul style="list-style-type: none"> * Fully discharge or over-discharge battery, pour out electrolyte, use distilled water to clean it repeatedly, fill electrolyte, and re-charge
3	Plate active material scales off	<ul style="list-style-type: none"> * Battery capacity decreases appreciably * When charging, battery capacity can not be restored easily * When charging, electrolyte is turbid and in grey color * When charging, electrolyte boils too early 	<ul style="list-style-type: none"> * Charging current is too high * When charging, temperature is too high * Battery is over-charged too often * Discharging current is too high. Long-time discharging at low temperature and great current would bend plates 	<ul style="list-style-type: none"> * Charging current must not be too high * Each operation of starter must not be longer than 5s. The interval between every two starts must be longer than 15s 	<ul style="list-style-type: none"> * When active material scaling off is not serious, pour out electrolyte, use distilled water to clean it repeatedly, fill electrolyte, and re-charge * If the problem is serious, replace plate set or discard
4	Plates are shorted	<ul style="list-style-type: none"> * battery terminal voltage decreases appreciably * When charging, electrolyte temperature rises appreciably, terminal voltage and electrolyte density rise slowly * At the end of charging, there are not enough bubbles 	<ul style="list-style-type: none"> * Separator is damaged * Active materials coming off from plates settle down at the bottom of battery and short the plates 		<ul style="list-style-type: none"> * Disassemble and replace separators or plates * Discard if the problem is serious

2 Schematic Diagram of Charging System Circuit



(1) Attention should be paid to the following points when using AC generator charging system:

- ① The polarity of battery grounding must be the same as that of generator.
- ② Do not check if generator is generating electricity by the method of observing sparks by instantaneously grounding the generator output terminal.
- ③ Do not remove battery and other main power consumption equipment while generator is running normally.
- ④ The operating voltage of generator should be as specified.
- ⑤ Fan belt tension should be as specified.
- ⑥ Do not use AC voltage higher than 220V or megger to check the insulation strength of generator.

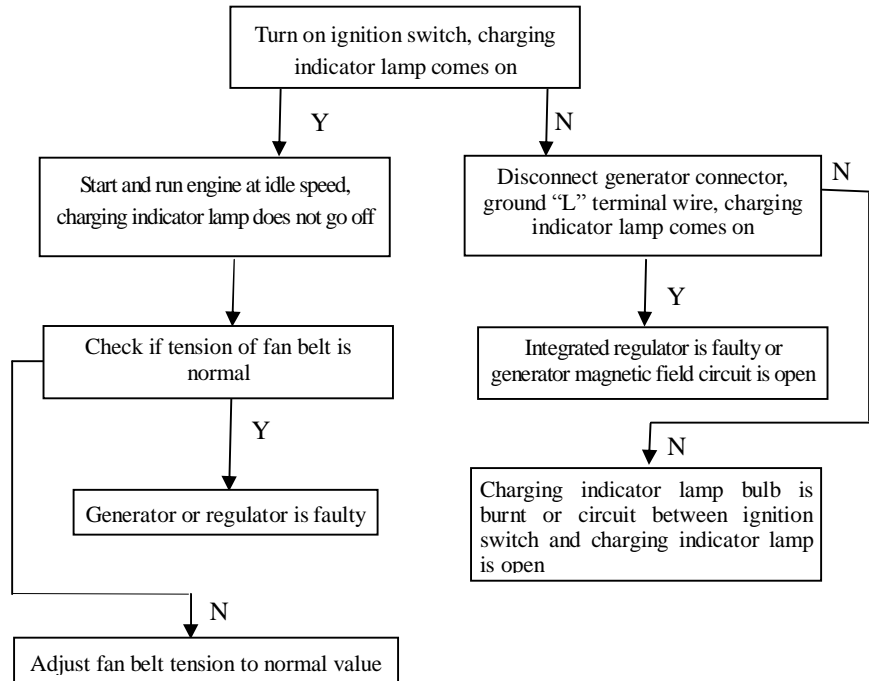
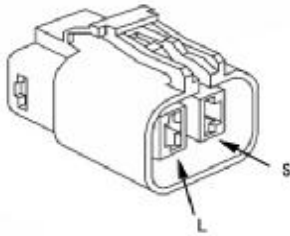
2 Common Troubles and Troubleshooting of Charging System

Common trouble phenomena, troubleshooting and remedy of charging system of generator are given in the following Table:

S/N	Phenomena of Trouble	Troubleshooting		Remedy
		Location of Trouble	Causes of Trouble	
1	No charging	Charging circuit	* Circuit connections are loose or open.	* Tighten connections.
			* Wires are broken.	* Replace wires.
		Generator	* Rotor or stator winding is shorted, open or grounded.	* Repair, and replace if necessary.
			* Silicon diode in rectifier is damaged.	* Replace rectifier or diode.
			* Brush is worn or seized in brush holder.	* Replace brush or brush holder.
			* Terminal post insulation is damaged.	* Repair.
		Regulator	* Regulating voltage is too low.	* Adjust or replace regulator.
			* Transistor (or integrated circuit) regulator is damaged.	* Replace regulator.
			* Contacts of contact-type regulator are oxidized or burnt.	* Clean contacts or replace regulator.
2	Insufficient charging	Charging circuit	* Connecting wires are poor condition, connecting points are loose or in poor contact.	* Tighten, clean wire connecting point or replace wire.
		Generator	* Rotor or stator winding interlayer is shorted.	* Re-wind or replace.
			* Brush is worn, brush holder is poor condition, brush spring force is insufficient.	* Replace brush, brush holder or brush spring.
			* Collector ring is dirty or worn.	* Clean, repair or replace collector ring.
			* Belt is too loose.	* Adjust belt tension.
			* Silicon diode is in poor condition or damaged.	* Replace diode or rectifier.
		Regulator	* Regulator contact in poor contact.	* Clean contact or replace regulator.
			* Transistor (or integrated circuit) regulator performance is poor.	* Replace regulator.
			* Regulating voltage is too low.	* Adjust or replace regulator.
3	Charging current is too high or over-charged often	Charging circuit	* Magnetic field terminal post and generator output terminal are shorted.	* Repair.
		Regulator	* Regulating voltage is too high.	* Adjust or replace regulator.
			* Regulator is poorly grounded (contact-type).	* Repair.
			* Low speed contact is burnt or high speed contact is in poor contact.	* Repair or replace regulator.
			* Transistor (or integrated circuit) regulator is damaged.	* Replace regulator.
		Battery	* Battery is shorted internally.	* Repair or replace battery.
4	Charging current is unstable	Charging circuit	* Wire connections are loose or connecting wire insulation is damaged.	* Tighten contacts.
		Generator	* Stator winding is shorted between turns.	* re-wind or replace stator winding.
			* brush is worn	* Replace brush.
			* brush and collector ring in poor contact	* Clean or adjust.
			* brush spring is damaged.	* Replace brush spring.
			* Collector ring surface is scratched or out of roundness.	* Repair or replace collector ring.
		Regulator	* Regulator is in poor contact.	* Clean contact.
			* Regulator is poorly grounded.	* Repair.
			* Transistor (or integrated circuit) regulator performance is poor.	* Replace regulator.

3 Fault Diagnosis of Charging System

Automobile is fit with charging indicator lamp. Fault diagnosis can be made by referring to the indication of the charging indicator lamp with the help of multimeter. Carry out fault diagnosis according to the actual circuit of charging system by following the steps given the Diagram below:



Starter Fault Diagnosis and Maintenance

The starter of automobile is short-time operating power consumption equipment. When starting engine, it generates electromagnetic torque to drive the flywheel of the engine to rotate crankshaft and start the engine. After engine is started, the electric power is de-energized, driving gear is withdrawn, and the starter stops operating.

1 Common trouble and diagnosis of starter

Use of starter

In use of starter, attention should be paid to the following points:

- (1) Ensure the starter, battery, ignition switch and starting relay are in good technical condition, and various connecting points are firmly connected and in good contact.
- (2) Ensure that charging system operates normally, so as to maintain battery in fully charged state all the time.
- (3) Each operation of starter must not be longer than 5s, and the interval between every two starts must not be shorter than 15s.
- (4) When energizing starter, neutral position must be engaged or clutch pedal stepped. Do not move automobile wheels by method of starting by engaging gears.
- (5) After engine is started, the operator must turn off starting switch timely to stop the starter, so as to reduce one-direction wear of the clutch.

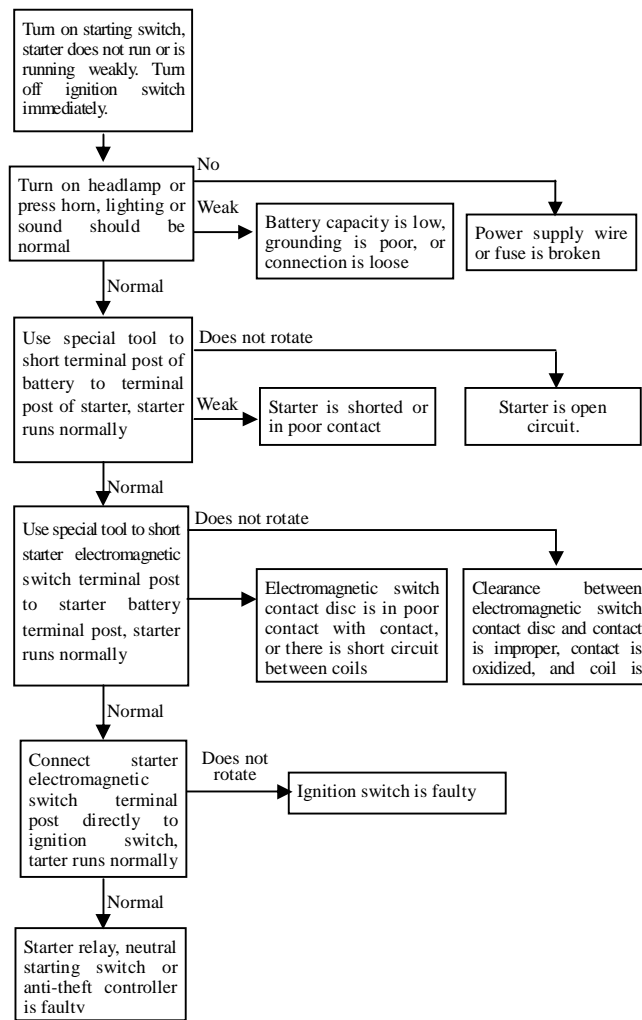
Analysis of common troubles of starting system

As for common trouble and trouble remedy of starting circuit, refer to Table below:

S/N	Phenomena of Trouble	Troubleshooting		Remedy
		Location of Trouble	Causes of Trouble	
1	Turn on starting switch, starter does not operate	Starter circuit	* Various connecting points between battery and starter are oxidized, dirty or loose.	* Check, clean and tighten connecting points.
			* Battery is grounded poorly.	* Check grounding points.
			* Connecting wires are in poor condition.	* Replace wires.
		Battery	* Capacity is too low.	* Check and remove troubles of charging system, or charging
			* Battery is shorted or vulcanized internally.	* Repair or replace battery
		Ignition switch	* Ignition switch starting step is damaged.	* Replace ignition switch.
		Starting relay	* Relay contact is oxidized, or solenoid is shorted or open.	* Clean contact, repair or replace relay.
		Starter	* Electromagnetic switch is damaged, contact disc or contact is oxidized.	* Repair or replace electromagnetic switch
			* Brush is worn or brush spring is damaged.	* Replace brush or brush spring.
			* Commutator is oxidized and brush is in poor contact.	* Repair commutator.
			* Armature or field coil is open or shorted.	* Repair, and replace if necessary.

2	Starter is weak, engine can not be started	Starter circuit	* Wire connection from battery to starter is loose or in poor contact.	* Tighten or clean contacts.
		Battery	* Battery charging system is faulty. * Battery is faulty, starting performance is deteriorated.	* Check charging system and charge * Repair or replace battery.
		Starter	* Electromagnetic switch contact disc or contact is oxidized.	* Clean contact.
			* Brush is worn, spring is bad	* Replace.
			* Commutator is oxidized and in poor contact with brush.	* Use fine sand paper to grind commutator, and turn it if necessary.
3	Driving gear moves out and engaged with flywheel, but starter does not run	Starter	* Armature or field coil is locally open, shorted or in poor contact	* Repair, and replace armature or field coil if necessary.
			* Electromagnetic switch contact disc or contact is oxidized	* Repair.
			* Brush is worn, brush spring is damaged.	* Replace brush or brush spring
			* Commutator is oxidized	* Clean commutator.
4	Starter is running, but driving gear does not engage with flywheel	Starter	* Armature or field coil is open or shorted.	* Repair, and replace armature or field coil if necessary.
			* Torsional spring is damaged.	* Replace.
5	Starter is running idly, engine can not be started	Starter	* One-way clutch is damaged.	* Replace.
6	After starting and starting switch is turned off, starter is still running	Starter	* Electromagnetic switch contact disc and contact is stuck.	* Repair.
			* driving fork spring is damaged.	* Replace spring.
		Starting relay	* Contact is stuck.	* Repair or replace.
		Ignition switch	* Starting step is damaged.	* Replace ignition switch.

Fault Diagnosis of Starting System (see diagram)



2 Servicing and Performance Test of starter

Servicing of starter

(1) Disassembly of starter

After starter is confirmed to have trouble through fault diagnosis, remove the starter from the engine, disassemble, inspect and repair.

Before removing starter from engine, the ignition switch should be turned off, and cable should be disconnected from battery negative terminal, and wait for 20s. All wires disconnected from the starter must be marked properly. Do not connect these wires on starter. If there are thin washers between starter and engine, they should be re-installed.

(2) Servicing of starter

① Inspection of armature

Check armature winding

Inspection of armature winding open circuit: Set multimeter at Ω step, and connect both probes respectively to two commutator segments, there should be continuity. No continuity between commutator segments indicates open circuit of armature, and repair, re-winding or replacement is required.

Inspection of armature winding short circuit: Place armature on armature tester, switch on power supply, place a saw blade above the armature and rotate the armature, the saw blade should not jerk. Jerking of saw blade indicates that the armature is shorted and re-winding or replacement is required.

Inspection of armature winding grounding: Set multimeter at Ω step, and connect both probes respectively to commutator segment and iron core, the resistance should be infinite. If resistance is not infinite or is zero, it indicates that the armature winding is grounded and re-winding or replacement is required.

Check commutator

Commutator surface should be clean and free from oxidization and burns. Minor burns can be removed by using No. 00 sand paper, and turning is required when it serious.

Check the roundness of commutator. Maximum runout is 0.05mm. If runout exceeds specified value, repair it by using a lathe.

Check the condition of grooves between commutator segments: the grooves should be clean and free from foreign matters, and the minimum depth of the grooves should be 0.2mm. If the depth is smaller than the specified value, use saw blade to scrape the grooves to the specified depth. Check that the diameter of commutator should not be smaller than the specified value. Otherwise, replace the commutator.

Check armature shaft

Check the bending of armature shaft:

The radial runout of armature shaft should not exceed the specified value, otherwise, calibration should be made.

② Inspection of field coil

Check field coil open circuit:

Set multimeter at Ω step, and connect both probes respectively to brush and terminal, there should be continuity. No continuity indicates that field coil is open and re-winding or replacement is required

Check field coil grounding:

Set multimeter at Ω step, and connect both probes respectively to case and terminal, the resistance should be infinite. If resistance is not infinite or is zero, it indicates that field coil is grounded, and repair or re-winding is required.

③ Inspection of brush, brush spring and brush holder

Check brush height:

Use a vernier caliper to measure brush height which should be as specified and not shorter than 2/3 of the height of the brush. Otherwise, replace it.

Check spring tension:

Use a strain gauge to measure the tension of the spring which should be as specified.

Check brush holder:

Set multimeter at Ω step, and connect both probes respectively to “+” and “-” brush holders, the resistance should be infinite. If resistance is not infinite or is zero, it indicates that brush holder is damaged, and replacement is required.

④ Inspection of driving gear, one-way clutch and bearing

Check that driving gear and flywheel should be free from serious wear or damage. Replace them if they are seriously worn or missing teeth.

Check one-way clutch:

Rotate the driving gear in counter-clockwise direction (or clockwise direction), and make sure that the gear is able to rotate flexibly, and is locked when rotating in opposite direction. Otherwise, it indicates that one-way clutch is damaged, and should be replaced.

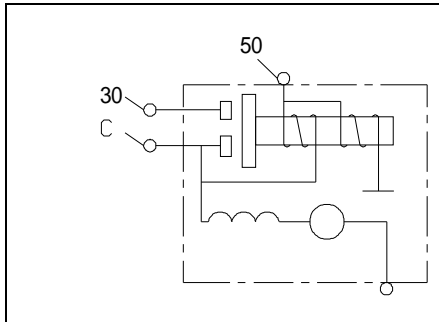
Check bearing:

Rotate the bearing by hand with force applied inwards, and make sure that it rotates flexibly. If the bearing rotates with difficulty or is jammed, the bearing should be replaced.

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⑤ Inspection of electromagnetic switch

The schematic diagram of electromagnetic switch circuit is shown as in the figure.

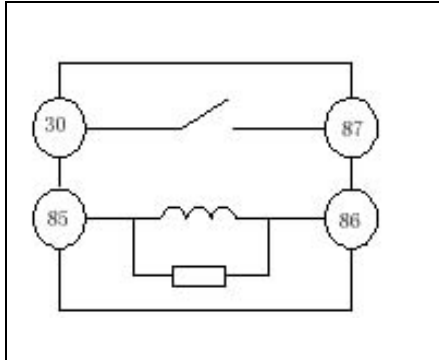


Check pull-in winding:

Set multimeter at Ω step, and connect both probes respectively to terminals “50” and “C”, there should be continuity. No continuity indicates that pull-in winding is open, and electromagnetic switch should be replaced.

Check holding winding:

Set multimeter at Ω step, and connect both probes respectively to terminal “50” and chassis, there should be continuity. No continuity indicates that holding winding is open, and electromagnetic switch should be replaced.



(3) Assembly of starter

Assemble the inspected and repaired starter in the sequence opposite to that of disassembly. While assembly is made, the following parts must be inspected and adjusted depending upon the structure of the starter.

- ① Check journal and bushing of armature shaft, and re-ream and fit.
- ② Before assembly, coat shaft teeth, journal, bushing, bearing and reduction gear with grease.
- ③ After assembly, rotate the driving gear in the operating direction of the starter, and check the concentricity of the bushing. If rotation is not flexible, it means that the bushing is not concentric, and the bushing should be adjusted or replaced, and re-ream and fit.
- ④ Check and adjust the clearance between the driving gear at operating position and stop washer. The clearance should be 1~4mm approx.

The adjustment can be made by means of adjusting screw.

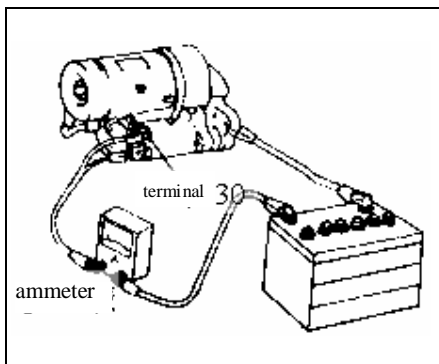
Inspection of starting relay

Schematic diagram of starting relay circuit is shown as follows:

Set multimeter at Ω step, and connect both probes respectively to terminals “30” and “87”, there should be no continuity. If there is, it means that contacts are burnt, and the contacts should be serviced or the relay should be replaced.

Connect both probes respectively to terminals “85” and “86”, there should be continuity. No continuity indicates that relay coil is open, and the relay should be replaced.

Apply battery voltage between terminals “85” and “86”, there should be continuity between terminals “30” and “87”. No continuity indicates that contact is oxidized or relay coil is open, and the contacts should be cleaned or the relay should be replaced.



Performance test of starter

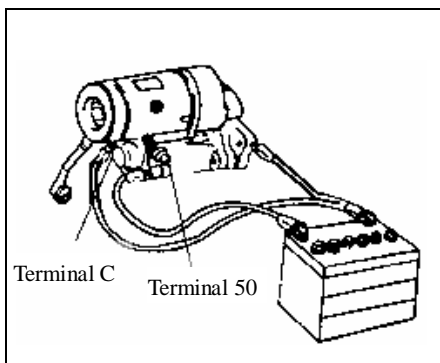
(1) Free running test:

Clamp the starter in a vice, and connect its case to battery negative pole (see diagram), terminal “30” to terminal “50”, and ammeter to the positive of battery, the driving gear should move out and rotate smoothly, and the current and rotating speed are as specified.

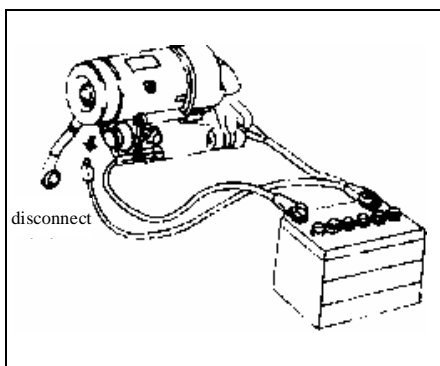
If the current is big and rotating speed is low, it shows that there is circuit or mechanical fault. If both current and rotating speed is low, it shows that there is problem of poor contact.

(2) Check electromagnetic switch:

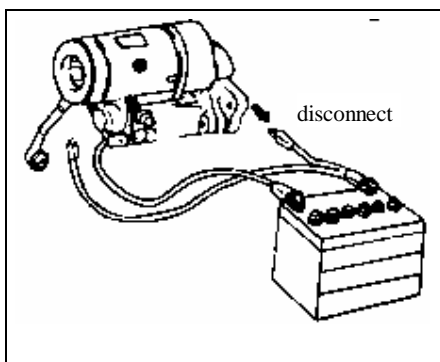
Disconnect motor lead from terminal “C” (see diagram), and connect battery “+” to terminal “50”. When both terminal “C” and case are connected to battery “—”, the driving gear should be able to move out, otherwise, it means that the pull-in winding is open, and the electromagnetic switch should be replaced.



After the driving gear moves out, disconnect the connecting wire between terminal “C” and battery “—” (see diagram) , the driving gear should not be retracted, otherwise, it means that the holding winding is open, and electromagnetic switch should be replaced.



Disconnect the connecting wire between starter and battery “—” (see diagram) , the driving gear should be retracted at once, otherwise, it means that the return spring is damaged, and electromagnetic switch should be repaired or replaced.



Fault Diagnosis and Maintenance of Engine Management System

1 Functional description of system

(1) Crankshaft position reference and rotating speed measurement

The system judges crankshaft position, measures engine rotating speed, and accurately controls engine ignition and injection timing according to 58X-tooth signal.

(2) Measurement of air by speed/density approach

ECM calculates and determines the amount of air entering into the cylinder by means of intake air temperature and air inlet manifold pressure sensors, and makes air-fuel ratio meet the requirements of various operating conditions by controlling fuel delivery.

(3) Engine sequential control by cylinder detection

The system adopts manifold pressure cylinder detection technique to realize sequential control of the engine.

(4) Camshaft cylinder detection

The camshaft position sensor and the gear installed on the camshaft work together to supply engine-cylinder top dead center information to ECM, and ECM determines the working sequence of the engine various cylinders according to these information (applicable to 4G22D4 engine).

(5) MAPCID air inlet manifold pressure cylinder detection

When engine cylinder is working in intake stroke, intake valve suddenly opens, and the manifold pressure near intake valve would drop sharply by about 1kPa. The sharp drop of pressure is detected by intake air pressure sensor, and ECM divides and processes this signal by means of software, and realizes cylinder detection (applicable to 4G64 and 491 engines).

(6) Closed-loop control

The system controls fuel delivery to and idle of engine in closed-loop. The advantage of closed-loop control is that the system possesses the ability to eliminate difference generated due to reasons of manufacture or wear in use of the system and the relevant mechanical parts and assemblies, so as to improve the integrity and conformity of the complete vehicle.

(7) Sequential control

The system adopts sequential control method to control fuel delivery to and ignition of the engine. The advantage of the sequential control is to control cylinders individually in consideration of difference among various cylinders of the engine, so as to improve the integral performance of the engine.

(8) Grouped control

The system divides the four cylinders of the engine into two groups (1-4 and 2-3) and controls their ignition respectively.

(9) Fuel injection system

The system injects fuel sequentially at multipoint by speed/density approach. It delivers fuel accurately via main pulse width and reformed pulse width in each engine cycle. It also possesses closed-loop control and self learning functions.

(10) Ignition control

The system accurately controls ignition coil magnetizing and discharging time by means of group ignition and "Magnetize and Discharge" logic.

(11) Detonation control

The detonation sensor is of frequency response type. ECM filters the received signals. The system controls independently the ignition timing of various cylinders of the engine.

(12) Idle speed control system

Idle speed control system possesses such functions as closed-loop control, self learning, altitude correction, out of step automatic adjustment and intelligent resetting, depending upon operating state of the engine.

(13) Gaseous emission control

The system uses three-way catalytic converter to process the gas burnt in the engine, and converts it into harmless gas, and emits it into the atmosphere. ECM adopts closed-loop fuel control according to oxygen sensor signal, and makes catalytic converter reach its highest conversion efficiency.

(14) Protection function of three-way catalytic converter

ECM evaluates temperature of three-way catalytic converter according to the operating condition of the engine. When the evaluated temperature is higher than the temperature that can be withstood by the three-way catalytic converter within a long time, the system will automatically initiate the three-way catalytic converter protection function to control temperature of the three-way catalytic converter.

(15) Evaporative emission control

The system controls the cleaning rate of charcoal canister according to the operating condition of the engine.

(16) Over-voltage protection (optional)

When charging system is defective and causes the voltage to become too high, the system would enter a protection state, so as to limit engine rotating speed and prevent ECM from being damaged.

(17) Mileage recording function

ECM may record the mileage of vehicle in EEPROM, so as to facilitate after-sale service and maintenance. When automobile speed sensor is faulty, measures can be taken to limit the controllability.

(18) System electronic anti-theft device function

ECM realizes communication according to special communication protocol of electronic anti-theft device, and reliably realizes anti-theft function according to feedback information of the electronic anti-theft device.

(19) Fault diagnosis function

After the system enters into operating state, ECM controls the operation of all parts and assemblies of the system, and checks these parts and assemblies in real time. Once the system or its parts and assemblies become faulty, ECM will initiate standby "emergency control solution" function, and illuminates "engine fault indicator lamp" to remind vehicle driving personnel to carry out maintenance timely.

(20) Communication interface and communication protocol

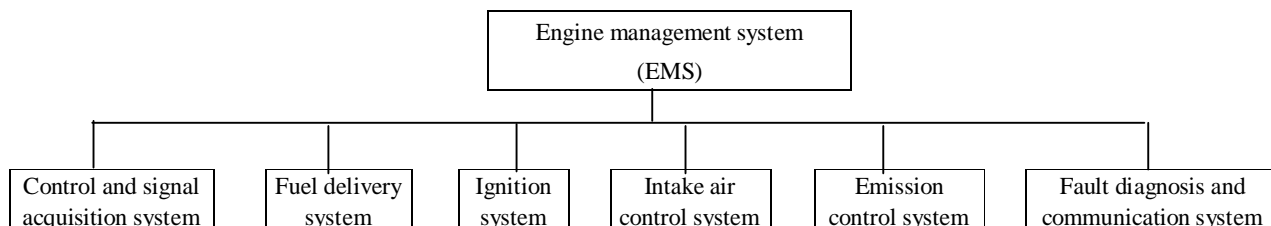
The system makes series communication via KeyWord2000 protocol used at fault diagnosis interface with external equipment.

(21) Automobile accessory control

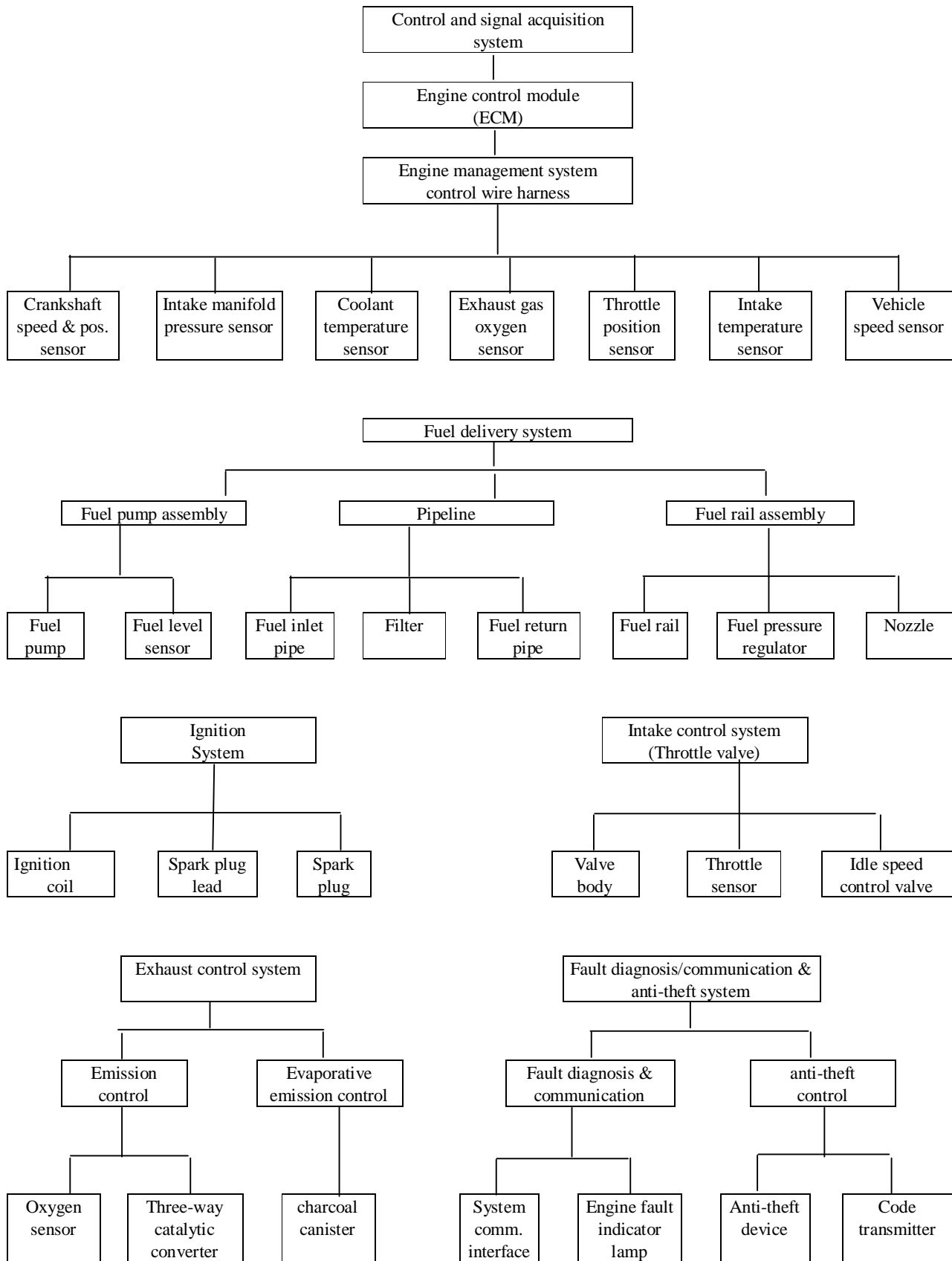
The system electrically controls engine cooling water tank fan and air conditioner condenser fan. ECM senses air conditioner temperature by means of evaporator outlet temperature sensor and controls the operation of the air compressor via relays.

2 System parts and assemblies

The hardware of engine management system operates under the control engine control module (ECM). The hardware includes control and signal acquisition, fuel delivery, ignition, intake air control, emission control, fault diagnosis and communication subsystems (see diagram).



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The following is a list of basic function parts and assemblies of MT20 (U) engine management system:

S/N	Description	Qty of Use
1	Engine control module (ECM)	1
2	Intake manifold pressure/temperature sensor	1
3	Coolant temperature sensor	1
4	Heated oxygen sensor (front)	1
5	Heated oxygen sensor (rear) (used for Euro III)	1
6	Fuel rail assembly (including WCPR fuel pressure regulator and Multec 3.5 fuel injector)	1
7	Throttle valve body assembly (including throttle position sensor and idle speed air control valve)	1
8	Crankshaft position sensor	1
9	Charcoal canister cleaning control electromagnetic switch	1
10	Double ignition coil assembly	1
11	Detonation sensor	1
12	Electric fuel pump assembly	1
13	Front stage three-way catalytic converter (used for Euro III)	1
14	Rear three-way catalytic converter M82	1

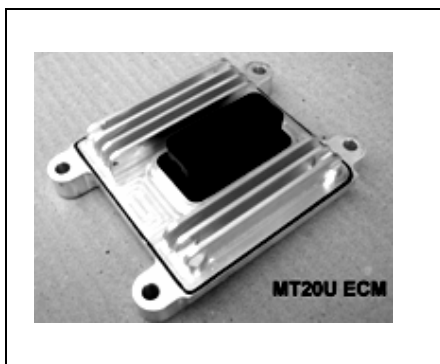
(1) Engine control module (ECM)

Function

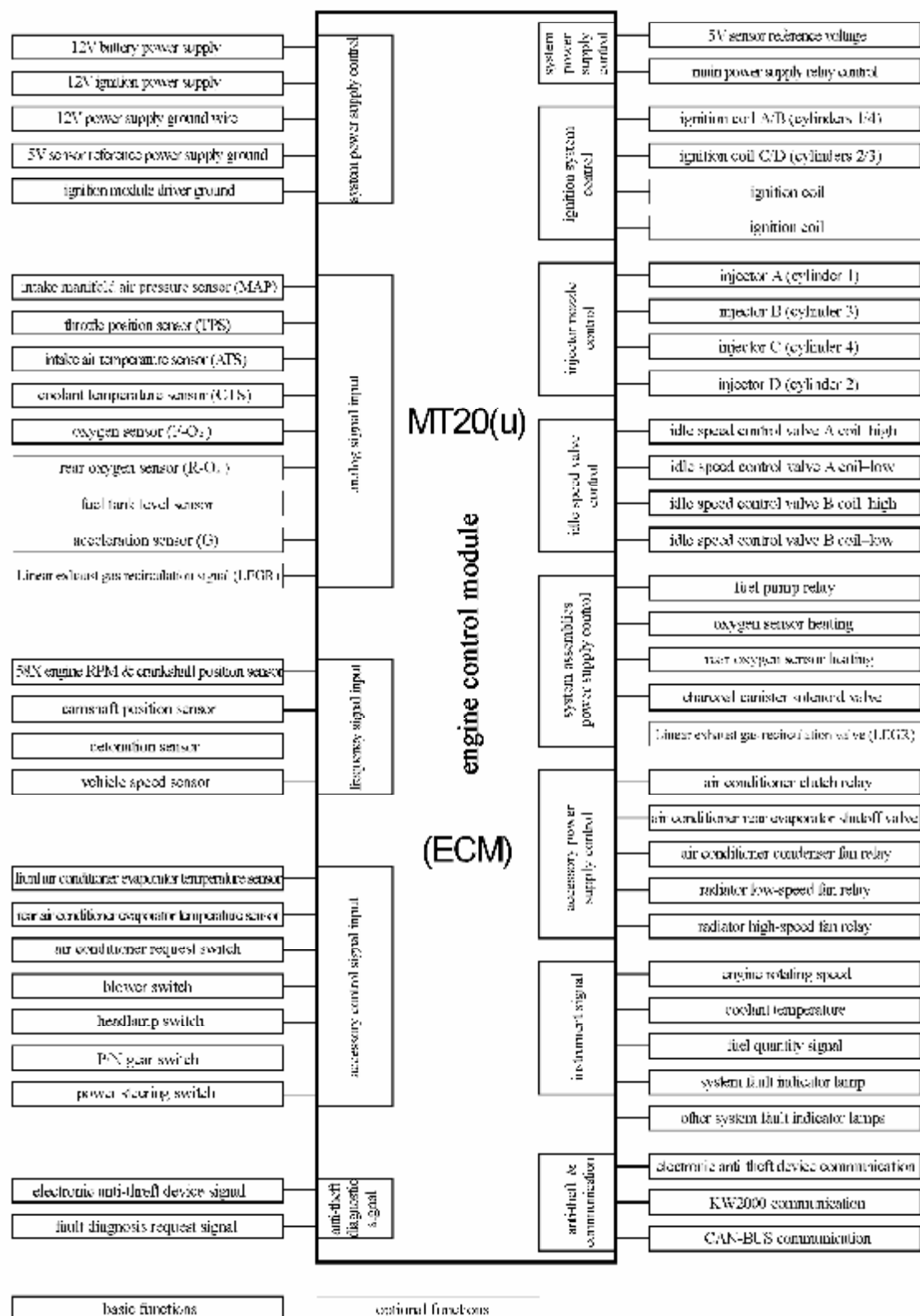
Engine control module (see diagram) is a microprocessor with a single chip computer as its core. Its function is to process data coming from various sensors of the vehicle, judges the operating state of the engine, and accurately controls the engine through various actuators. As listed in the following Table.

Operating parameter

Normal operating voltage range:	9.0V~16V
Over-voltage and reversed polarity voltage protection:	+24V/-12V<60sec.
Storage temperature:	-40~125℃
Operating temperature:	-40~105℃



Functions of MT20(u) Engine Control Module (ECM)



3 Routine use and service

Fuel and lubricating oil

Fuel used should be No. 93 unleaded gasoline. The content of lead or other heavy metals in leaded gasoline must meet the requirement set in current national standard. Too much lead or other heavy metals in fuel may poison oxygen sensor and three-way catalytic converter and make them defective permanently. Sulfur content in fuel should also meet the requirement set in current national standard. Sulfur poison oxygen sensor and three-way catalytic converter and make them defective temporarily. The seriousness of sulfur poison can be relieved by driving the vehicle at the speed of 70km/h for 10 min. Gasoline with higher sulfur content is usually in brown color.

The consumption of engine oil should be at a normal level. If engine oil enters and burns in cylinders, phosphate in oil may make oxygen sensor and three-way catalytic converter defective permanently.

Routine use and service

- (1) When starting engine, do not operate any controls on the engine (including throttle). In cold weather, clutch can be disengaged.
- (2) Drive vehicle once a while at high speed, so as to remove carbon deposit in engine and exhaust system.
- (3) If engine fault indicator lamp comes on while engine is running, find the causes of fault and remove the trouble as early as possible.
- (4) When cylinder is found misfire, stop the vehicle and look for the reason immediately. Because unburnt mixture would burn in exhaust manifold, resulting in quick damage of oxygen sensor and three-way catalytic converter. If ignition fault can not be removed within a short time, you can temporarily disconnect fuel injector nozzle plug of the cylinder with misfire, and drive the vehicle at middle or low speed to a service station to be repaired.
- (5) When battery voltage is insufficient or starter is faulty, do not start the engine by external force for a long time. As after the system is powered, once engine running signal is received, fuel injection would begin. If the engine can not be ignited within a long time, unburnt fuel will accumulate inside the three-way catalytic converter, once the engine begins to operate, the accumulated fuel may damage the catalytic converter.
- (6) Valve clearance should not be too small. If exhaust can not be loosed tightly, exhaust temperature would become too high and shorten the life of the three-way catalytic converter.
- (7) During long-term storage, run the engine or vehicle once every month, so as to prevent fuel nozzle and fuel pump from being stuck.
- (8) Gasoline filter should be replaced once every 7,000~10,000km. Under normal operating conditions, flow restricting valve and nozzles should be cleaned once every year or 20,000km. When cleaning nozzles without removing them, make sure that additive does not contain any substances harmful to oxygen sensor and three-way catalytic converter.
- (9) When making double idle speed emission test, the engine and three-way catalytic converter must be fully warmed up. Make high idle speed measurement first, and then make low idle speed measurement. Warm up engine and catalytic converter as follows:
 - ① Drive the vehicle at 3rd gear and 70km/h speed for 5 min, and check its emission within 8 min.
 - ② Gently step on the gas, let the engine run freely at a rotating speed of over 4,500rpm for 2 min, and check the emission within 2 min.

4 Tools for maintenance

Commonly-used tools for maintenance

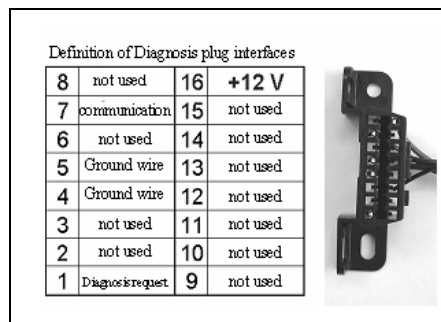
- (1) Tools for removal and installation of electrically-controlled system parts and assemblies. Commonly-used tools for removal and installation of automobile mechanical parts and assemblies.
- (2) Tools for measurement of electrically-controlled system circuit and system electrical signal: digital multimeter (with buzzer).
- (3) Instrument for measurement of system square wave and pulse wave signals: oscilloscope.
- (4) Instrument for measurement of fuel pressure: pressure gage with a range of 0~1MPa.
- (5) For fault code reading: code reader.
- (6) For checking electrically-controlled system fault diagnosis and engine operating conditions: automobile electrically-controlled system fault diagnostic device or Delphi PCHud computer measurement and control software.

Engine fault indicator lamp

When engine is running, if system or parts and assemblies is faulty, engine fault indicator lamp will automatically come on, reminding vehicle driving personnel to check and service timely.

In emergencies, special operation can be carried out to make engine fault indicator lamp flash, and read engine fault code. This is the best way to obtain fault codes. The operating method is introduced as follows:

- (1) Check and determine: battery voltage is able to guarantee the starting rotating speed of engine; the engine and vehicle accessories are in off state; and throttle is fully closed; and transmission is set at neutral position.
- (2) Turn off ignition switch.
- (3) Use a wire to short diagnosis request terminal 1 of fault diagnosis plug (see diagram) to ground terminal 4 or 5.
- (4) Turn ignition switch to ON, but do not start the engine.
- (5) Now, if the system possesses fault or historical fault code not cleared after fault is removed, the engine fault indicator lamp flashes at a certain frequency, and fault codes detected by the system are output. (At the same time fault codes are being read, idle speed control valve will act to reset itself).



- (6) Upon the completion of reading of fault codes, turn off ignition switch, and disconnect the diagnosis request shorting wire.
- (7) The law of fault reporting by indicator lamp is as follows:

It reports faults in the order of fault codes memorized.

There will be a 3.2 seconds pause between each two fault codes. Numbers will blink at a frequency of 0.4 second (i.e. illuminate for 0.4 sec. and extinguish for 0.4 sec.). There is a 1.2 sec. pause between each two digits.

Number 0 blinks 10 times, and other numbers correspond to number of times of blinks.

Take fault codes 0110 and 0443 as example (as shown in the following diagram):



- (8) **Caution:** After troubles are removed, we recommend you use fault diagnostic device to clear the fault codes, so that troubleshooting is not affected in next maintenance.

**Code reader (fault code reader)**

Although fault codes can be read from fault indicator lamp, but it is rather complicated and needs special training. The use of code reader is simpler and easier. The code reader is as shown in the following diagram. Code reader is manufactured and provided by fault diagnostic device manufacturer. Its use is introduced as follows:

- (1) Check and determine: battery voltage is able to guarantee the starting rotating speed of engine; the engine and vehicle accessories are in off state; and throttle is fully closed; and transmission is set at neutral position.
- (2) Turn off ignition switch.
- (3) Connect code reader to fault diagnosis plug.
- (4) Turn ignition switch to ON.
- (5) Now, code reader displays fault codes cyclically in the order of fault codes memorized.
- (6) Upon the completion of reading of fault codes, turn off ignition switch, and disconnect code reader.
- (7) **Caution: After troubles are removed, we recommend you use fault diagnostic device to clear the fault codes, so that troubleshooting is not affected in next maintenance.**

**Fault diagnostic device**

The main functions of fault diagnostic device (see diagram) include reading of system operating data flow and system information, temporary control and detection over system parts and assemblies, reading or clear of fault codes. As it is easy to operate, it has become a main tool for vehicle fault diagnosis and system condition checking. As for the method of use, refer to its Operating Manual.

PCHud computer measurement and control software

PCHud is tool software used to connect personnel computer (PC) to Delphi engine control module. Using this tool software, the operating and control parameters of vehicle and engine equipped with Delphi engine management system can be read, recorded and analyzed through personnel computer.

5 Typical faults and remedy

Precautions for maintenance

(1) Preparation for maintenance

Do not carry out vehicle maintenance at gas stations.
Do not carry out maintenance of fuel system near fire.
Do not smoke while carrying out maintenance.

(2) Remove fuel system parts and assemblies (for example: replacing filter, removing fuel pump or fuel rail inlet/return pipelines).

First disconnect battery negative pole, so as to prevent accidental shorting of circuit and generation of discharging sparks from igniting fuel vapor.

Use cloth to cover pipeline joints and then, carefully loosen joints to release pressure in the pipeline.

During the operation, do not let fuel splash on the engine or its hot exhaust pipeline.

Keep gasoline away from rubber or leather parts.

Replace fuel inlet/return pipes with gasoline-resistance pipes that can withstand fracture pressure of greater than 2MPa.

(3) Removal and maintenance of electronic control system parts and assemblies

The reliability of parts and assemblies of electric injection system is comparatively high. When vehicle or engine is abnormal, first check the conditions of relevant mechanical parts and assemblies, system connector and wiring harness, grounding, and high-tension wire connector of spark plug and fuel pressure regulator vacuum pipes. Before making sure that the electric injection parts and assemblies are damaged, replacement, test and check should be made repeatedly.

When battery voltage is insufficient or starter is faulty, do not use external force to start the engine for a long time, so as not to damage three-way catalytic converter.

When maintenance is required, first turn off the ignition switch or disconnects the battery negative pole. Never remove or install electronic parts and assemblies with power supply on.

Do not check electrical signals of the system by using needle to puncture into wiring harness.

While engine is running, do not disconnect battery plug if not absolutely necessary.

When external electrical tools such as soldering iron are used, make sure to disconnect battery and ECM plugs.

Do not check the operating state of ignition system by disconnecting spark plug lead. As now the nozzles are still operating, the injected unburnt gasoline would burn inside and damage the three-way catalytic converter.

When carrying out checks by replacing ECM, make sure to see if the vehicle is equipped with computer anti-theft device. If yes, first disconnect the power supply of the anti-theft device, and then replace ECM, otherwise the new ECM would be locked by the anti-theft device and will be unable to work on other vehicles.

Do not let parts subject to drastic strikes during the process of removal and installation.

DO not open the cover of ECM.

When replacing and removing oxygen sensor, do not let the sensor come into contact with or other liquids.

Do not operate fuel pumps without fuel for long time, and do not operate in the air with gasoline.

The majority of electric injection parts are unrepairable. After it is confirmed that a part is damaged, the part is usually replaced.

The system should use anti-interference spark plug and high-tension wire. Non-impedance spark plug and high-tension wire not only emits interference waves, but also generates harmful influences to the ignition coil driving module in ECM, or even damages ECM.

(4) Close-out

Check all circuit connectors and fuel pipelines are connected properly and secured firmly.

Damaged wires should be repaired timely.

High-tension wires must be well connected.

When connecting battery connectors, special care should be taken and make sure that the positive/negative poles are not wrongly connected, and battery connectors are firmly and reliably connected.

Fault code and emergency control solution

(1) Fault code

After the system enters operating state and engine is running, ECM controls the operation of all parts and assemblies of the system, and monitors in real time those parts and assemblies directly connected to the system. When one or several parts and assemblies of the system become abnormal, the system will automatically generate warning. Each fault state is given a dedicated code. Once a fault occurs, the system will output the code (referred as fault code) for that fault through diagnosis interface, and at the same time, illuminates “engine fault indicator lamp” to remind vehicle driving personnel to conduct maintenance timely. Fault code indicates probable causes of faults.

When fault occurs, the system may adopt temporary emergency solution to control the operation of the engine, so as to make sure that the user may drive the vehicle to a service station for repair.

Delphi MT20(u) engine management system fault codes are listed in the following Tables:

Important Notices: System fault codes can only be used to locate faults of parts and assemblies directly connected to ECM.

Fault code	Description of Faults	Fault code	Description of Faults
P0105-1	Intake manifold absolute pressure sensor signal is too high	P0443-1	charcoal canister solenoid valve circuit is shorted to power supply positive pole
P0105-2	Intake manifold absolute pressure sensor signal is too low	P0443-2	charcoal canister solenoid valve circuit is open or shorted to ground
P0110-1	Intake temperature sensor signal is too low	P0480-1	Water tank low speed fan relay driving circuit is shorted to power supply positive pole
P0110-2	Intake temperature sensor signal is too high	P0480-2	Water tank low speed fan relay driving circuit is open or shorted to ground
P0115-1	Coolant temperature sensor signal is too low	P0481-1	Water tank high speed fan relay driving circuit is shorted to power supply positive pole
P0115-2	Coolant temperature sensor signal is too high	P0481-2	Water tank high speed fan relay driving circuit is open or shorted to ground
P0120-1	Throttle position sensor signal is too high	P0482-1	Air conditioner cooling fan relay driving circuit is shorted to power supply positive pole
P0120-2	Throttle position sensor signal is too low	P0482-2	Air conditioner cooling fan relay driving circuit is open or shorted to ground
P0130-4	No oxygen sensor signal	P0500-0	No automobile speed sensor signal
P0135-1	Oxygen sensor heating circuit is shorted to power supply positive pole	P0505-0	Idle speed control is defective
P0135-2	Oxygen sensor heating circuit is open or shorted to ground	P0560-1	System voltage is too high
P0170-1	Oxygen sensor indicates that time of air-fuel ratio being rich is too long	P0607-0	Detonation control system is defective
P0170-2	Oxygen sensor indicates that time of air-fuel ratio being lean is too long	P0650-1	Fault indicator lamp circuit is shorted to power supply positive pole
P0201-0	Injector A(1cylinder) circuit is faulty	P0650-2	Fault indicator lamp circuit is open or shorted to ground
P0202-0	Injector B(3cylinder) circuit is faulty	P1230-1	Main relay circuit is shorted to power supply positive pole
P0203-0	Injector C(4cylinder) circuit is faulty	P1230-2	Main relay circuit is open or shorted to ground
P0204-0	Injector D(2cylinder) circuit is faulty	P1530-1	Air conditioner relay circuit is shorted to power supply positive pole
P0230-1	Fuel pump relay is shorted to power supply positive pole	P1530-2	Air conditioner relay circuit is open or shorted to ground

Fault code	Description of Faults	Fault code	Description of Faults
P0230-2	Fuel pump relay is open or shorted to ground	P1604-0	EEPROM is faulty
P0325-0	Detonation sensor connection is poor	P1610-0	Anti-theft controller is faulty
P0335-0	No 58x crankshaft position sensor signal	P1610-8	ECM and anti-theft device communication is faulty
P0335-8	58x crankshaft position sensor signal is wrong	P2000-1	Front air conditioner evaporator temperature is too high
P0342-0	Camshaft position signal is low	P2000-2	Front air conditioner evaporator temperature is too low
P0343-2	Camshaft position signal is high	P2001-1	Rear air conditioner evaporator temperature is too high
P0351-1	Cylinders 1 & 4 ignition coil driving circuit is shorted to power supply positive pole	P2001-2	Rear air conditioner evaporator temperature is too low
P0351-2	Cylinders 1 & 4 ignition coil driving circuit is open or shorted to ground	P2100-2	Rear air conditioner cutoff relay is shorted to battery
P0352-1	Cylinders 2 & 3 ignition coil driving circuit is shorted to power supply positive pole	P2100-8	Rear air conditioner cutoff relay is open or shorted to ground
P0352-2	Cylinders 2 & 3 ignition coil driving circuit is open or shorted to ground		

(2) Troubleshooting (see Tables below)

Fault code: P0105-1		Intake manifold absolute pressure sensor signal is too high			
Set emergency control solution:		Illuminate fault indicator lamp until fault disappears When engine stops: 90kPa At engine idle speed: ≈ 45 kPa While engine is running: manifold pressure changes with the opening of throttle If cylinder pressure detection technique is adopted, there is probability of 50% that injection sequence displaces by 360 degrees			
Terminal:	MT20	MT20U	Pressure sensor	Pressure /temperature sensor	Normal measurement signal
5V reference voltage:	27	04	C	B	5V
Manifold pressure signal:	25	42	B	A	0.5~4.5V
Sensor signal ground:	28	21	A	D	0V
Conditions of determination		Possible causes of trouble		Remedy	
- Engine is running - No TPS fault - MAP>98.117kpa - TPS<19.141% - Fault duration >2.5 sec.		1) Wiring harness pressure signal circuit is shorted to 5V reference voltage or power supply positive 2) Sensor is damaged 3) Pressure signal input interface on ECM is faulty		1) Repair wire bundle 2) Replace sensor 3) Replace ECM	

Fault code: P0105-2		Intake manifold absolute pressure sensor signal is too low			
Set emergency control solution:		Illuminate fault indicator lamp until fault disappears When engine stops: 90kPa At engine idle speed: ≈ 45 kPa While engine is running: manifold pressure changes with the opening of throttle If cylinder pressure detection technique is adopted, there is probability of 50% that injection sequence displaces by 360 degrees			
Terminal:	MT20	MT20U	pressure sensor	pressure /temperature sensor	Normal measurement signal
5V reference voltage:	27	04	C	B	5V
Manifold pressure signal:	25	42	B	A	0.5~4.5V
Sensor signal ground:	28	21	A	D	0V

Conditions of determination	Possible causes of trouble	Remedy
- No TPS fault - MAP<14.017kpa - RPM<1050rpm - TPS>18.75% - Fault duration >2.5s	1) Connector is not connected properly 2) Wiring harness pressure signal circuit is open 3) Wiring harness pressure signal circuit is shorted to ground 4) 5V reference voltage is open 5) Sensor signal ground is open 6) Wiring harness 5V reference voltage is opposite to reference ground (this fault might damage the sensor) 7) Sensor is damaged 8) ECM MAP signal input interface is faulty	1) Reconnect 2) Repair wire bundle 3) Repair wire bundle 4) Repair wire bundle 5) Repair wire bundle 6) Repair wire bundle 7) Replace sensor 8) Replace ECM

Fault code: P0110-1 Intake temperature sensor signal is too low					
Set emergency control solution:	Illuminate fault indicator lamp until fault disappears Intake temperature is equal to coolant temperature, but not exceeds 44.25℃				
Terminal:	MT20	MT20U	Intake temperature sensor	Pressure /temperature sensor	Normal measurement signal
Intake temperature signal:	35	27	B	C	0.5~4.5V
Sensor signal ground:	28	21	A	D	0V
Conditions of determination	Possible causes of trouble		Remedy		
- Engine running time >120s - MAT<-38.25℃ - Fault duration >2s	1) Connector is not connected properly 2) temperature signal circuit is open 3) Sensor signal ground is open 4) Temperature signal circuit is shorted to power supply positive pole 5) Sensor is damaged 6) The signal input interface of ECM is faulty		1) Reconnect 2) Repair wire bundle 3) Repair wire bundle 4) Repair wire bundle 5) Replace sensor 6) Replace ECM		

Fault code: P0110-2 Intake temperature sensor signal is too high					
Set emergency control solution:	Illuminate fault indicator lamp until fault disappears Intake temperature is equal to coolant temperature, but not exceeds 44.25℃				
Terminal:	MT20	MT20U	Intake temperature sensor	pressure /temperature sensor	Normal measurement signal
Intake temperature signal:	35	27	B	C	0.5~4.5V
Sensor signal ground:	28	21	A	D	0V
Conditions of determination	Possible causes of trouble			Remedy	
- Engine running time >60s - MAT>148.5℃ - Fault duration >2s	1) Temperature signal circuit is shorted to ground 2) Sensor is damaged 3) The signal input interface of ECM is faulty is faulty			1) Repair wire bundle 2) Replace sensor 3) Replace ECM	

Fault code: P0115-1 Coolant temperature sensor signal is too low				
Set emergency control solution:	Illuminate fault indicator lamp until fault disappears Intake temperature at starting will rise to 79.5℃ as time goes and fix at this value			
Terminal:	MT20	MT20U	Coolant temperature sensor	Normal measurement signal
Coolant temperature signal:	34	43	B	0.5~4.5v
Sensor signal ground:	37	05	A	0v
Conditions of determination	Possible causes of trouble		Remedy	
-Engine running time >10s -CTS<-38.25℃ -Fault duration >2s	1) Connector is not connected properly 2) temperature signal circuit is open 3) Sensor signal ground is open 4) temperature signal circuit is shorted to power supply positive pole 5) Sensor is damaged 6) The signal input interface of ECM is faulty is faulty		1) Reconnect 2) Repair wire bundle 3) Repair wire bundle 4) Repair wire bundle 5) Replace sensor 6) Replace ECM	

Fault code: P0115-2		Coolant temperature sensor signal is too high		
Set emergency control solution:		Illuminate fault indicator lamp until fault disappears Intake temperature at starting will rise to 79.5℃ as time goes and fix at this value		
Terminal:	MT20	MT20U	Coolant temperature sensor	Normal measurement signal
Coolant temperature signal:	34	43	B	0.5~4.5v
Sensor signal ground:	37	05	A	0v
Conditions of determination	Possible causes of trouble		Remedy	
- Engine running time >2s - CTS>135℃ - Fault duration >2s	1) Temperature signal circuit is shorted to ground 2) Sensor is damaged 3) The signal input interface of ECM is faulty is faulty		1) Repair wire bundle 2) Replace sensor 3) Replace ECM	

Fault code: P0120-1		Throttle position sensor signal is too high		
Set emergency control solution:		Illuminate fault indicator lamp until fault disappears At idle speed, set the opening of throttle position sensor 0%.At other rotating speeds, the opening of throttle position sensor changes with the rotating speed. Throttle position sensor automatic zero calibrating function is stopped temporarily. Cleaning function is stopped temporarily		
Terminal:	MT20	MT20U	Throttle position sensor	Normal measurement signal
5V reference voltage:	36	20	A	5V
Throttle position signal:	26	24	C	0.5~4.5V
Sensor signal ground:	37	05	B	0V
Conditions of determination	Possible causes of trouble		Remedy	
-Engine is running, but rotating speed <3000rpm -No MAP fault, and MAP<70kPa -Fault duration >2s	1) Sensor signal circuit is shorted to power supply positive pole or reference voltage circuit 2) Sensor is damaged 3) The signal input interface of ECM is faulty is faulty		Repair wire bundle Replace sensor Replace ECM	

Fault code: P0120-2		Throttle position sensor signal is too low		
Set emergency control solution:		Illuminate fault indicator lamp until fault disappears At idle speed, set the opening of throttle position sensor 0%.At other rotating speeds, the opening of throttle position sensor changes with the rotating speed. Throttle position sensor automatic zero calibrating function is stopped temporarily. Cleaning function is stopped temporarily		
Terminal:	MT20	MT20U	Throttle position sensor	Normal measurement signal
5V reference voltage:	36	20	A	5V
Throttle position signal:	26	24	C	0.5~4.5V
Sensor signal ground:	37	05	B	0V
Conditions of determination	Possible causes of trouble		Remedy	
- Fault duration >2s	1) Connector is not connected properly 2) Sensor signal circuit is open 3) Sensor signal circuit is shorted to ground 4) Sensor is damaged 5) The signal input interface of ECM is faulty is faulty		1) Reconnect 2) Repair wire bundle 3) Repair wire bundle 4) Replace sensor 5) Replace ECM	

Fault code: P0130-4	No oxygen sensor signal			
Set emergency control solution:	Illuminate fault indicator lamp until fault disappears Air-fuel ratio can not be controlled in closed-loop			
Terminal:	MT20	MT20U	Heated oxygen sensor	Normal measurement signal
System main power supply:	\	\	C	12V
Heating driver:	\	61	D	0V
Oxygen sensor high signal:	31	62	B	0~1000mV fluctuation
Oxygen sensor low signal:	55	06	A	0V
Conditions of determination	Possible causes of trouble		Remedy	
- 360.24mV<oxygen sensor signal <538.19mV - Engine running time >40s - No TPS and MAP faults - coolant temperature >72℃ - Enter into closed-loop fuel control state - TPS>10.156% - Duration >15s	1) Connector is not connected properly 2) Sensor signal circuit is open 3) Sensor is defective due to poisoning or overheat 4) The signal input interface of ECM is faulty		1) Reconnect 2) Repair wire bundle 3) Replace sensor 4) Replace ECM	

Fault code: P0135-1	Oxygen sensor heating circuit is shorted to power supply positive pole			
Set emergency control solution:	Illuminate fault indicator lamp until fault disappears and ignition switch is turned off System closed-loop operating time is delayed			
Terminal:	MT20	MT20U	Heated oxygen sensor	Normal measurement signal
System main power supply:	\	\	C	12V
Heating driver:	\	61	D	0V
Oxygen sensor high signal:	31	62	B	0~1000mV fluctuation
Oxygen sensor low signal:	55	06	A	0V
Conditions of determination	Possible causes of trouble		Remedy	
- Duration >1s	1) Heating driving circuit is shorted to power supply positive pole 2) Sensor is damaged 3) ECM signal output control interface is faulty		1) Repair wire bundle 2) Replace sensor 3) Replace ECM	

Fault code: P0135-2	Oxygen sensor heating circuit is open or shorted to ground			
Set emergency control solution:	Illuminate fault indicator lamp until fault disappears and ignition switch is turned off System closed-loop operating time is delayed			
Terminal:	MT20	MT20U	Heated oxygen sensor	Normal measurement signal
System main power supply:	\	\	C	12V
Heating driver:	\	61	D	0V
Oxygen sensor high signal:	31	62	B	0~1000mV fluctuation
Oxygen sensor low signal:	55	06	A	0V
Conditions of determination	Possible causes of trouble		Remedy	
- No main relay fault - Duration >1s	1) Connector is not connected properly 2) Wiring harness heating driving circuit is open 3) Wiring harness heating driving circuit is shorted to ground 4) Sensor is damaged 5) ECM signal output control interface is faulty		1) Reconnect 2) Repair wire bundle 3) Repair wire bundle 4) Replace sensor 5) Replace ECM	

Fault code: P0170-1		Oxygen sensor indicates that the time of air-fuel ratio being rich is too long		
Set emergency control solution:		Illuminate fault indicator lamp until fault disappears Air-fuel ratio can not be controlled in closed-loop		
Terminal:	MT20	MT20U	Heated oxygen sensor	Normal measurement signal
System main power supply:	\	\	C	12V
Heating driver:	\	61	D	0V
Oxygen sensor high signal:	31	62	B	0~1000mV fluctuation
Oxygen sensor low signal:	55	06	A	0V
Conditions of determination		Possible causes of trouble	Remedy	
- Oxygen sensor signal >998.26mV - Engine running time >40s - No TPS and MAP faults - coolant temperature >72℃ - Enter into closed-loop fuel control state - TPS>10.156% - Duration>15s		1) Sensor signal circuit is shorted to 5V or 12V 2) Sensor is damaged 3) The signal input interface of ECM is faulty	1) Repair wire bundle 2) Replace sensor 3) Replace ECM	

Fault code: P0170-1		Oxygen sensor indicates that the time of air-fuel ratio being lean is too long		
Set emergency control solution:		Illuminate fault indicator lamp until fault disappears Air-fuel ratio can not be controlled in closed-loop		
Terminal:	MT20	MT20U	Heated oxygen sensor	Normal measurement signal
System main power supply:	\	\	C	12V
Heating driver:	\	61	D	0V
Oxygen sensor high signal:	31	62	B	0~1000mV fluctuation
Oxygen sensor low signal:	55	06	A	0V
Conditions of determination		Possible causes of trouble	Remedy	
- Oxygen sensor signal <52.083mV - Engine running time >40s - No TPS and MAP faults - coolant temperature >72℃ - Enter into closed-loop fuel control state - TPS>10.156% - Duration >15s		1) Sensor signal circuit is shorted to ground 2) Sensor high and low signal circuits are reversed 3) Sensor is damaged 4) ECM signal input interface is faulty	1) Repair wire bundle 2) Repair wire bundle 3) Replace sensor 4) Replace ECM	

Fault code:	P0201-0	Injector A (1 cylinder) circuit is faulty		
	P0202-0	Injector B (3 cylinder) circuit is faulty		
	P0203-0	Injector C (4 cylinder) circuit is faulty		
	P0204-0	Injector D (2 cylinder) circuit is faulty		
Set emergency control solution:		Illuminate fault indicator lamp until fault disappears None		
Terminal:	MT20	MT20U	Nozzle	Normal measurement signal
System main power supply:	\	\	A	12V
Injector A (1 cylinder):	70	55	B	0-12V approx. square wave
Injector B (3 cylinder):	61	56	B	0-12V approx. square wave
Injector C (4 cylinder):	60	71	B	0-12V approx. square wave
Injector D (2 cylinder):	49	70	B	0-12V approx. square wave
Conditions of determination		Possible causes of trouble	Remedy	
- Ignition switch is turned on - Fuel pump operates normally - ignition voltage >10V		1) Corresponding nozzle circuit is shorted to power supply positive pole or ground 2) Corresponding nozzle circuit is open 3) Connector is not connected properly 4) Nozzle circuit is damaged 5) ECM signal output control interface is faulty	1) Repair wire bundle 2) Repair wire bundle 3) Reconnect 4) Replace damaged nozzle 5) Replace ECM	

Fault code: P0230-1	Fuel pump relay is shorted to power supply positive pole			
Set emergency control solution:	Illuminate fault indicator lamp until fault disappears None			
Terminal:	MT20	MT20U	fuel pump relay	Normal measurement signal
System main power supply:	\	\	\	12V
Relay driver:	09	47	\	0V (operate), 12V(stop)
Conditions of determination	Possible causes of trouble		Remedy	
- Duration >1.5625s	1) Relay driving circuit is shorted to system power supply positive pole 2) Relay is damaged 3) ECM signal output control interface is faulty		1) Repair wire bundle 2) Replace relay 3) Replace ECM	

Fault code: P0230-2	Fuel pump relay is open or shorted to ground			
Set emergency control solution:	Illuminate fault indicator lamp until fault disappears None			
Terminal:	MT20	MT20U	fuel pump relay	Normal measurement signal
System main power supply:	\	\	\	12V
Relay driver:	09	47	\	0V (operate), 12V(stop)
Conditions of determination	Possible causes of trouble		Remedy	
- Duration >1.5625s	1) Connector is not connected properly 2) System main power supply is open 3) Relay driving circuit is shorted to system power supply negative pole 4) Relay driving circuit is open 5) Relay is damaged 6) ECM signal output control interface is faulty		1) Reconnect 2) Repair wire bundle 3) Repair wire bundle 4) Repair wire bundle 5) Replace relay 6) Replace ECM	

Fault code: P0325-0	Detonation sensor connection is poor			
Set emergency control solution:	Illuminate fault indicator lamp until ignition switch is turned off Use safe ignition advance angle table			
Terminal:	MT20	MT20U	Detonation sensor	Normal measurement signal
Detonation signal:	23	69	2	0~1V
Sensor signal ground:	37	05	1	0V
Conditions of determination	Possible causes of trouble		Remedy	
- Engine rotating speed >2000rpm - MAP>50kPa - Duration >5s	1) Connector is not connected properly 2) Detonation signal circuit is open 3) Sensor signal ground id shorted 4) Detonation signal circuit is shorted to other circuits 5) Sensor is damaged 6) ECM signal output control interface is faulty		1) Reconnect 2) Repair wire bundle 3) Repair wire bundle 4) Repair wire bundle 5) Replace sensor 6) Replace ECM	

Fault code:	P0335-0	No 58x crankshaft position sensor signal			
Set emergency control solution:		Illuminate fault indicator lamp until fault disappears None Engine can not be started			
Terminal:	MT20	MT20U	Crankshaft position sensor	Normal measurement signal	
Crankshaft signal is high:	41	12	A	>400mV sine wave (and sensor B)	
Crankshaft signal is low:	33	28	B	>400mV sine wave (and sensor A)	
System ground wire:	06, 21, 29, 45	73	C	0V	

Conditions of determination	Possible causes of trouble	Remedy
<ul style="list-style-type: none"> - Start engine - No engine rotating speed signal - MAP decreases by 2.9509kPa - System voltage drops by 0.8V - Automobile speed <4km/h - Duration >2s 	<ul style="list-style-type: none"> 1) Connector is not connected properly 2) High and low signals are connected in reverse 3) Signal circuit is open 4) Signal circuit is shorted to other circuits 5) Sensor is damaged 6) The signal input interface of ECM is faulty is faulty 	<ul style="list-style-type: none"> 1) Reconnect 2) Repair wire bundle 3) Repair wire bundle 4) Repair wire bundle 5) Replace sensor 6) Replace ECM

Fault code:	P0335-8	58x crankshaft position sensor signal is wrong			
Set emergency control solution:		Illuminate fault indicator lamp until fault disappears None			
Terminal:	MT20	MT20U	Crankshaft position sensor	Normal measurement signal	
Crankshaft signal is high:	41	12	A	>400mV sine wave (and sensor B)	
Crankshaft signal is low:	33	28	B	>400mV sine wave (and sensor A)	
System ground wire:	06, 21, 29, 45	73	C	0V	
Conditions of determination		Possible causes of trouble		Remedy	
- Engine is running - In consecutive 5 cycles, the number of teeth entering ECM is not equal to 58		1) Signal circuit is poorly shielded 2) There is foreign metal objects in 58x ring gear		1) Use shielding wire 2) Clean 58x ring gear	

Fault code:	P0342-0	Camshaft position signal is low			
Set emergency control solution:	Illuminate fault indicator lamp until fault disappears There is probability of 50% that injection sequence displaces by 360 degrees				
Terminal:	MT20	MT20U	Camshaft position sensor	Normal measurement signal	
5V reference voltage:	27	04	C	5V	
Camshaft signal:	30	10	A	0-5V square wave	
Sensor signal ground:	37	05	B	0V	
Conditions of determination	Possible causes of trouble			Remedy	
- Engine is running	1) Connector is not connected properly 2) Reference voltage circuit is open 3) Signal ground is open 4) Camshaft signal circuit is open 5) Sensor is damaged 6) ECM interface is faulty			1) Reconnect 2) Repair wire bundle 3) Repair wire bundle 4) Repair wire bundle 5) Replace sensor 6) Replace ECM	

Fault code:	P0343-2	Camshaft position signal is high			
Set emergency control solution:		Illuminate fault indicator lamp until fault disappears There is probability of 50% that injection sequence displaces by 360 degrees			
Terminal:	MT20	MT20U	Camshaft position sensor	Normal measurement signal	
5V reference voltage:	27	04	C	5V	
Camshaft signal:	30	10	A	0-5V square wave	
Sensor signal ground:	37	05	B	0V	
Conditions of determination		Possible causes of trouble		Remedy	
- Engine is running	1) Camshaft signal circuit is faulty 2) Sensor is damaged 3) ECM signal output control interface is faulty		1) Repair wire bundle 2) Replace sensor 3) Replace ECM		

Fault code:	P0351-1	Cylinders 1 & 4 ignition coil driving circuit is shorted to power supply positive pole			
Set emergency control solution:	Illuminate fault indicator lamp until fault disappears Stop injecting fuel into cylinders 1 & 4 Target idle speed is raised to 1,200rpm				
Terminal:	MT20	MT20U	Ignition coil	Normal measurement signal	
System main power supply:	\	\	B	12V	
Cylinders 1 & 4 driver:	46,57	32	C	0-12V approx. square wave signal induction peak>300V	
Cylinders 2 & 3 driver:	50,62	52	A	0-12V approx. square wave signal induction peak>300V	
Conditions of determination	Possible causes of trouble			Remedy	
- Duration 1.25s	1) Cylinders 1 & 4 driving circuit is shorted to power supply positive pole 2) Ignition coil is damaged 3) ECM is faulty			1) Repair wire bundle 2) Replace ignition coil 3) Replace ECM	

Fault code:	P0351-2	Cylinders 1 & 4 ignition coil driving circuit is open or shorted to ground		
Set emergency control solution:	Illuminate fault indicator lamp until fault disappears Stop injecting fuel into cylinders 1 & 4			
Terminal:	MT20	MT20U	Ignition coil	Normal measurement signal
System main power supply:	\	\	B	12V
Cylinders 1 & 4 driver:	46,57	32	C	0-12V approx. square wave signal induction peak>300V
Cylinders 2 & 3 driver:	50,62	52	A	0-12V approx. square wave signal induction peak>300V
Conditions of determination	Possible causes of trouble		Remedy	
- Duration 1.25s	1) Connector is not connected properly 2) Cylinders 1 & 4 driving circuit is shorted to system power supply negative pole 3) cylinders 1 & 4 driving circuit is open 4) Ignition coil is damaged 5) ECM is faulty		1) Reconnect 2) Repair wire bundle 3) Repair wire bundle 4) Replace ignition coil 5) Replace ECM	

Fault code:	P0352-1	Cylinders 2 & 3 ignition coil driving circuit is shorted to power supply positive pole			
Set emergency control solution:	Illuminate fault indicator lamp until fault disappears Stop injecting fuel into cylinders 2 & 3 Target idle speed is raised to 1200rpm				
Terminal:	MT20	MT20U	Ignition coil	Normal measurement signal	
System main power supply:	\	\	B	12V	
Cylinders 1 & 4 driver:	46,57	32	C	0-12V approx. square wave signal induction peak>300V	
Cylinders 2 & 3 driver:	50,62	52	A	0-12V approx. square wave signal induction peak>300V	
Conditions of determination	Possible causes of trouble			Remedy	
- Duration 1.25s	1) Cylinders 2 & 3 driving circuit is shorted to power supply positive pole 2) Ignition coil is damaged 3) ECM is faulty			1) Repair wire bundle 2) Replace ignition coil 3) Replace ECM	

Fault code:	P0352-2	Cylinders 2 & 3 ignition coil driving circuit is open or shorted to ground		
Set emergency control solution:	Illuminate fault indicator lamp until fault disappears Stop injecting fuel into cylinders 2 & 3			
Terminal:	MT20	MT20U	Ignition coil	Normal measurement signal
System main power supply:	\	\	B	12V
Cylinders 1 & 4 driver:	46,57	32	C	0-12V approx. square wave signal induction peak>300V
Cylinders 2 & 3 driver:	50,62	52	A	0-12V approx. square wave signal induction peak>300V
Conditions of determination	Possible causes of trouble		Remedy	
- Duration 1.25s	1) Connector is not connected properly 2) Cylinders 2 & 3 driving circuit is shorted to system power supply negative pole 3) Cylinders 2 & 3 driving circuit is open 4) Ignition coil is damaged 5) ECM is faulty		1) Reconnect 2) Repair wire bundle 3) Repair wire bundle 4) Replace ignition coil 5) Replace ECM	

Fault code:	P0443-1	Charcoal canister solenoid valve circuit is shorted to power supply positive pole		
Set emergency control solution:	Illuminate fault indicator lamp until fault disappears Close charcoal canister solenoid valve			
Terminal:	MT20	MT20U	Charcoal canister solenoid valve	Normal measurement signal
System main power supply:	\	\	B	12V
Solenoid valve driver:	10	63	A	0-12V square wave
Conditions of determination	Possible causes of trouble		Remedy	
- Duration >2s	1) Solenoid valve driving circuit is shorted to power supply positive pole 2) Solenoid valve is damaged 3) ECM is faulty		1) Repair wire bundle 2) Replace solenoid valve 3) Replace ECM	

Fault code:	P0443-2	Charcoal canister solenoid valve circuit is open or shorted to ground		
Set emergency control solution:		Illuminate fault indicator lamp until fault disappears Close charcoal canister solenoid valve		
Terminal:	MT20	MT20U	Charcoal canister solenoid valve	Normal measurement signal
System main power supply:	\	\	B	12V
Solenoid valve driver:	10	63	A	0-12V square wave
Conditions of determination	Possible causes of trouble		Remedy	
- Duration >5s	1) Connector is not connected properly 2) Solenoid valve driving circuit is shorted to system power supply negative pole 3) Solenoid valve driving circuit is open 4) Circuit connected to system main power supply is open 5) Solenoid valve is damaged 6) ECM is faulty		1) Reconnect 2) Repair wire bundle 3) Repair wire bundle 4) Repair wire bundle 5) Replace solenoid valve 6) Replace ECM	

Fault code:	P0480-1	Water tank low speed fan relay driving circuit is shorted to power supply positive pole		
Set emergency control solution:	Illuminate fault indicator lamp until fault disappears None Fan does not operate, until water temperature rises to 98 degrees, high speed fan turns on			
Terminal:	MT20	MT20U	Low speed fan relay	Normal measurement signal
Battery:	\	\	\	12V
Relay driver:	01	67	\	operate=0V, stop=12V
Conditions of determination	Possible causes of trouble		Remedy	
- Duration >3s	1) Relay driving circuit is shorted to power supply positive pole 2) Relay is damaged 3) ECM is faulty		1) Repair wire bundle 2) Replace relay 3) Replace ECM	

Fault code:	P0480-2	Water tank low speed fan relay driving circuit is open or shorted to ground			
Set emergency control solution:	Illuminate fault indicator lamp until fault disappears None Fan does not operate, until water temperature rises to 98 degrees, high speed fan turns on Fan is running all the time (shorted to ground)				
Terminal:	MT20	MT20U	Low speed fan relay	Normal measurement signal	
Battery:	\	\	\	12V	
Relay driver:	01	67	\	operate=0V, stop=12V	
Conditions of determination	Possible causes of trouble		Remedy		
- Duration >3s	1) Connector is not connected properly 2) Relay driving circuit is shorted to system power supply negative pole 3) Relay driving circuit is open 4) Circuit connected battery is open 5) Relay is damaged 6) ECM is faulty		1) Reconnect 2) Repair wire bundle 3) Repair wire bundle 4) Repair wire bundle 5) Replace relay 6) Replace ECM		

Fault code:	P0481-1	Water tank high speed fan relay driving circuit is shorted to power supply positive pole			
Set emergency control solution:	Illuminate fault indicator lamp until fault disappears None				
Terminal:	MT20	MT20U	high speed fan relay	Normal measurement signal	
Battery:	\	\	\	12V	
Relay driver:	08	50	\	operate=0V, stop=12V	
Conditions of determination	Possible causes of trouble			Remedy	
- Duration >3s	1) Relay driving circuit is shorted to power supply positive pole 2) Relay is damaged 3) ECM is faulty			1) Repair wire bundle 2) Replace relay 3) Replace ECM	

Fault code:	P0481-2	Water tank high speed fan relay driving circuit is open or shorted to ground			
Set emergency control solution:	Illuminate fault indicator lamp until fault disappears None Fan operates all the time (shorted to ground)				
Terminal:	MT20	MT20U	High speed fan relay	Normal measurement signal	
Battery:	\	\	\	12V	
Relay driver:	08	50	\	operate=0V, stop=12V	
Conditions of determination	Possible causes of trouble			Remedy	
- Duration >3s	1) Connector is not connected properly 2) Relay driving circuit is shorted to system power supply negative pole 3) Relay driving circuit is open 4) Circuit connected battery is open 5) Relay is damaged 6) ECM is faulty			1) Reconnect 2) Repair wire bundle 3) Repair wire bundle 4) Repair wire bundle 5) Replace relay 6) Replace ECM	

Fault code:	P0482-1	Air conditioner cooling fan relay driving circuit is shorted to power supply positive pole			
Set emergency control solution:	Illuminate fault indicator lamp until fault disappears None Fan does not work				
Terminal:	MT20	MT20U	Air conditioner fan relay	Normal measurement signal	
Battery:	\	\	\	12V	
Relay driver:	03	68	\	operate=0V, stop=12V	
Conditions of determination	Possible causes of trouble		Remedy		
- Duration >3s	1) Relay driving circuit is shorted to power supply positive pole 2) Relay is damaged 3) ECM is faulty		1) Repair wire bundle 2) Replace relay 3) Replace ECM		

Fault code:	P0482-2	Air conditioner cooling fan relay driving circuit is open or shorted to ground			
Set emergency control solution:	Illuminate fault indicator lamp until fault disappears None Fan does not work(open circuit) Fan works all the time (shorted to ground)				
Terminal:	MT20	MT20U	air conditioner fan relay	Normal measurement signal	
Battery:	\	\	\	12V	
Relay driver:	03	68	\	operate=0V, stop=12V	
Conditions of determination	Possible causes of trouble		Remedy		
- Duration >3s	1) Connector is not connected properly 2) Relay driving circuit is shorted to system power supply negative pole 3) Relay driving circuit is open 4) Circuit connected battery is open 5) Relay is damaged 6) ECM is faulty		1) Reconnect 2) Repair wire bundle 3) Repair wire bundle 4) Repair wire bundle 5) Replace relay 6) Replace ECM		

Fault code:	P0500-0	Automobile speed sensor has no signal		
Set emergency control solution:		Illuminate fault indicator lamp until fault disappears None Driving limiting measure might be taken		
Terminal:	MT20	MT20U	Automobile speed sensor	Normal measurement signal
Sensor signal ground:	38	03	3	0-12V square wave
Conditions of determination	Possible causes of trouble		Remedy	
- Engine is running - Automobile speed <2kph - MAP<25.82kPa - 1,200rpm<engine rotating speed <5,000rpm - Throttle is closed - Duration >5s	1) Connector is not connected properly 2) Wiring harness from sensor to ECM is broken 3) Automobile speed sensor is damaged 4) ECM is faulty		1) Reconnect 2) Repair wire bundle 3) Replace automobile speed sensor 4) Replace ECM	

Fault code:	P0505-0	Idle speed control is faulty		
Set emergency control solution:	Illuminate fault indicator lamp until fault disappears Idle speed adjustment is stopped temporarily			
Terminal:	MT20	MT20U	Idle speed control valve	Normal measurement signal
Idle speed valve A-high:	07	54	D	0-12V square wave(and idle speed valve C)
Idle speed valve A-low:	15	53	C	0-12V square wave(and idle speed valve D)
Idle speed valve B-high:	13	33	B	0-12V square wave(and idle speed valve A)
Idle speed valve A-low:	14	34	A	0-12V square wave(and idle speed valve B)
Conditions of determination	Possible causes of trouble		Remedy	
- Engine is running at idle speed - Water temperature reached normal value - No TPS and VSS faults - Deviation from target rotating speed>180rpm - Duration >15s	1) Connector is not connected properly 2) Any circuit of idle speed valve is open 3) Relation between idle speed valve connector and ECM connector is wrong 4) Intake manifold leaks 5) Idle speed control valve is damaged 6) ECM is faulty		1) Reconnect 2) Repair wire bundle 3) Repair wire bundle 4) Remove leakage trouble 5) Replace idle speed control valve 6) Replace ECM	

Fault code:	P0560-1	System voltage is too high			
Set emergency control solution:		Illuminate fault indicator lamp until fault disappears System stops fuel injection			
Terminal:	MT20	MT20U	Ignition switch	Normal measurement signal	
Ignition switch:	18	01	\	12V	
Conditions of determination		Possible causes of trouble		Remedy	
- Turn on ignition switch - System voltage >17.2V - Duration >5s		1) Generator regulator is damaged 2) Wrongly used high tension battery		1) Replace is damaged voltage regulator 2) Use correct battery	

Fault code:	P0607-0	Detonation control system is defective			
Set emergency control solution:	Illuminate fault indicator lamp until ignition switch is turned off Ignition advance angle is delayed (adopt safe ignition advance control)				
Terminal:	MT20	MT20U	ECM	Normal measurement signal	
ECM:	ECM internal fault	\			
Conditions of determination	Possible causes of trouble			Remedy	
- There is fault	1) ECM is faulty			1) Replace ECM	

Fault code:	P0650-1	Fault indicator lamp circuit is shorted to power supply positive pole			
Set emergency control solution:		Does not come on			
Terminal:	MT20	MT20U	System fault indicator lamp	Normal measurement signal	
Ignition switch:	\	\	Instrument power supply	12V	
Indicator lamp driver:	48	31	Inside of instrument	distinguish=12V, illuminate=0V	
Conditions of determination	Possible causes of trouble		Remedy		
- Duration >2s	1) Wiring harness J1-31 circuit is shorted to system power supply positive pole		1) Repair wire bundle		

Fault code:	P0650-2	Fault indicator lamp circuit is open or shorted to ground			
Set emergency control solution:	Does not come on (open circuit) Illuminate all the time (shorted to ground)				
Terminal:	MT20	MT20U	System fault indicator lamp	Normal measurement signal	
Ignition switch:	\	\	Instrument power supply	12V	
Indicator lamp driver:	48	31	Inside of instrument	distinguish=12V, illuminate=0V	
Conditions of determination	Possible causes of trouble		Remedy		
- Duration >2s	1) Fault indicator lamp bulb is not installed properly 2) Wire to ignition switch is faulty 3) Driving circuit is shorted to power supply negative pole 4) Fault indicator lamp bulb is damaged		1) Re-install bulb 2) Repair wire bundle 3) Repair wire bundle 4) Replace bulb		

Fault code:	P1530-1	Air compressor relay circuit is shorted to power supply positive pole			
Set emergency control solution:		Illuminate fault indicator lamp until fault disappears Air conditioner dose not work			
Terminal:	MT20	MT20U	Compressor relay	Normal measurement signal	
Battery:	\	\	\	12V	
Relay driver:	02	46	\	operate=0V, stop=12V	
Conditions of determination		Possible causes of trouble		Remedy	
- Air conditioner system is detected - Duration >3s		1) Repair wire bundle circuit is shorted to power supply positive pole 2) Relay is damaged 3) ECM is faulty		1) Repair wire bundle 2) Replace relay 3) Replace ECM	

Fault code:	P1530-2	Air compressor relay circuit is open or shorted to ground			
Set emergency control solution:		Illuminate fault indicator lamp until fault disappears Air conditioner does not work (open circuit) Air conditioner is working all the time (shorted to ground)			
Terminal:	MT20	MT20U	Compressor relay	Normal measurement signal	
Battery:	\	\	\	12V	
Relay driver:	02	46	\	operate=0V, stop=12V	
Conditions of determination	Possible causes of trouble		Remedy		
- Air conditioner system is detected - Duration >3s	1) Connector is not connected properly 2) Wire to battery is open 3) Repair wire bundle circuit power supply negative pole short circuit 4) Repair wire bundle circuit is open 5) Relay is damaged 6) ECM is damaged		1) Reconnect 2) Repair wire bundle 3) Repair wire bundle 4) Repair wire bundle 5) Replace relay 6) Replace ECM		

Fault code:	P1604-0	EEPROM is faulty			
Set emergency control solution:		Illuminate fault indicator lamp Engine on vehicle with anti-theft device can not be started Mileage accumulation function is lost			
Terminal:	MT20	MT20U	ECM	Normal measurement signal	
ECM:	ECM internal fault	\			
Conditions of determination	Possible causes of trouble			Remedy	
- Fault exists	1) ECM is faulty			1) Replace ECM	

Fault code:	P1610-0	Anti-theft controller is faulty		
Set emergency control solution:	Illuminate fault indicator lamp until fault disappears Engine can not be started			
Terminal:	MT20	MT20U	Anti-theft device (Delphi)	Normal measurement signal
ECM anti-theft request:	59	60	6	0-5V pulse
Anti-theft code:	64	07	8	0-5V pulse
Battery:	\	\	4	12V
Ignition switch:	\	\	3	12V
Anti-theft indicator lamp:	\	\	1	0-12V square wave
Ground:	\	\	2	0V
Conditions of determination	Possible causes of trouble		Remedy	
- Fault exists	1) Anti-theft device connector scaling off 2) Anti-theft device circuit is faulty 3) Anti-theft device is faulty		1) Reconnect 2) Repair wire bundle 3) Replace anti-theft device, and engage in anti-theft learning according to program	

Fault code:	P1610-8	ECM and anti-theft device communication is faulty			
Set emergency control solution:		Illuminate fault indicator lamp until fault disappears Engine can not be started			
Terminal:	MT20	MT20U	Anti-theft device (Delphi)	Normal measurement signal	
ECM anti-theft request:	59	60	6	0-5V pulse	
Anti-theft code:	64	07	8	0-5V pulse	
Battery:	\	\	4	12V	
Ignition switch:	\	\	3	12V	
Anti-theft indicator lamp:	\	\	1	0-12V square wave	
Ground:	\	\	2	0V	

Conditions of determination	Possible causes of trouble	Remedy
- Fault exists	1) Anti-theft device circuit is faulty 2) Anti-theft device connector scaling off 3) Anti-theft device is faulty 4) ECM anti-theft device interface is faulty	1) Repair wire bundle 2) Reconnect 3) Replace anti-theft device, and engage in anti-theft learning according to program 4) Replace ECM, and engage in anti-theft learning according to program

Fault code:	P2000-1	Front air conditioner evaporator temperature is too high			
Set emergency control solution:		Illuminate fault indicator lamp until fault disappears None			
Terminal:	MT20	MT20U	Front evaporator temperature sensor	Normal measurement signal	
Temperature signal:	39	26	2	0.5~4.5V	
Sensor signal ground:	37	05	5	0V	
Conditions of determination		Possible causes of trouble		Remedy	
- Temperature indication >144℃ - Duration >3s		1) Temperature signal circuit is shorted to power supply negative pole 2) Sensor is damaged 3) ECM is faulty		1) Repair wire bundle 2) Replace sensor 3) Replace ECM	

Fault code:	P2000-2	Front air conditioner evaporator temperature is too low			
Set emergency control solution:		Illuminate fault indicator lamp until fault disappears None			
Terminal:	MT20	MT20U	Front evaporator temperature sensor	Normal measurement signal	
temperature signal:	39	26	2	0.5~4.5V	
Sensor signal ground:	37	05	5	0V	
Conditions of determination	Possible causes of trouble		Remedy		
- Temperature indication >36℃ - Duration >3s	1) Connector is not connected properly 2) Temperature signal circuit is shorted to power supply positive pole 3) Temperature signal circuit is open 4) Sensor is damaged 5) ECM is faulty		1) Reconnect 2) Repair wire bundle 3) Repair wire bundle 4) Replace sensor 5) Replace ECM		

(3) Fault diagnosis and remedy without fault code (see Tables below)

Fault 01:	Fault diagnostic device is unable to communicate with the system	
Possible causes of trouble		Remedy
1) Diagnosis wire is not firmly connected 2) Diagnostic device function does not conform to the system 3) Diagnostic device is faulty 4) Relationship between diagnosis interface and ECM connector terminal is wrong 5) Lead corresponding to diagnosis interface is open 6) ECM communication is faulty		1) Reconnect diagnosis wire 2) Use diagnostic device corresponding to the vehicle and system 3) Remove faults of diagnostic device 4) Repair wire bundle 5) Repair wire bundle 6) Replace ECM

Fault 02:	Being unable to start	
Possible causes of trouble		Remedy
Fault indicator lamp: 1)Flashing - Anti-theft key is faulty - Anti-theft system circuit is faulty - Anti-theft device is damaged 2)Do not illuminate - Fuse - Grounding wire is open - ECM connector - bulb and circuit - ECM is faulty 3)Illuminate – use diagnostic device to check - There is fault code - There is no fault code		1) If key is correct or damaged - Re-learning key - Check circuit and reconnect plug - Replace anti-theft device, and learn as per program 2) - Replace - Check and repair - Reconnect - Repair wire bundle and bulb - Replace ECM 3) Use fault diagnostic device to make diagnosis - Remove fault detected - Check: system power supply, signal acquisition system, fuel delivery system, ignition system, idle speed control system, engine and vehicle mechanical system
System power supply: 1)When starter works, system voltage - <8V - >8V		1)Use fault diagnostic device to make diagnosis - Replace or charge battery - Check other system
Signal acquisition system: 1) There is no rotating speed data stream - Crankshaft position sensor wiring harness is open - Crankshaft position sensor connector terminal is reversed - Sensor and 58x target gear clearance is incorrect - Sensor is attached with foreign matters - Sensor is demagnetized or damaged 2)There is rotating speed data stream - Relative position between 58x gear and top dead center is incorrect		1) - Repair wire bundle - Repair wire bundle - Adjust clearance: 0.3~1.5mm - Clean sensor - Replace sensor 2)There is rotating speed data stream - Check: the falling edge of No. 20 tooth is top dead center of cylinders 1 & 4
Fuel delivery system: 1) Fuel inlet/return pipes are wrongly connected 2) Fuel pump circuit is open 3) Cylinder is flooded 4) Fuel inlet pipe pressure >250kPa - Nozzle is blocked 5) fuel inlet pipe pressure <250kPa - Fuel in fuel tank is insufficient - Fuel filter is blocked - Fuel inlet pipe leaks - Fuel pressure regulator is damaged - Fuel pump pressure is insufficient - Fuel evaporability is incorrect		1) Connect correctly 2) Repair vehicle wiring harness, reconnect fuel pump plug 3) Lightly flooded cylinder: fully open the throttle and start the starter Seriously flooded cylinder: remove spark plug and start the starter, repair after residual fuel in cylinder and spark plug is dried 4) - Replace nozzle 5) - Replenish fuel - Replace fuel filter - Replace fuel inlet pipe - Replace fuel pressure regulator - Replace fuel pump - Use fuel with suitable evaporability according to seasons

Ignition system: 1) Ignition coil connector 2) Cylinder sequence is incorrect 3) Spark plug is damaged 4) Ignition coil is damaged	1) Reconnect connector 2) Connect coil and spark plug according to Notes on coil 3) Replace spark plug 4) Replace ignition coil
Idle speed control system: 1) Gentle stepping on the gas can not start 2) Gentle stepping on the gas can start <ul style="list-style-type: none"> - Idle speed valve plug scaling off - Idle speed valve plug terminals do not correspond to ECM terminals - Idle speed valve is blocked - ECM constant power supply is interrupted - Idle speed valve is damaged - ECM is faulty 	1) Look for other causes 2) <ul style="list-style-type: none"> - Reconnect - Repair wire bundle - Clean flow regulating valve body - Repair wire bundle - Replace idle speed valve - Replace ECM
Intake/exhaust system: 1) Air filter is blocked 2) Three-way catalytic converter is blocked <ul style="list-style-type: none"> - Catalytic converter is damaged - Blocked by foreign matters burnt 	1) Clean intake passage, replace filter element 2) <ul style="list-style-type: none"> - Replace three-way catalytic converter - repair engine, replace three-way catalytic converter

Fault 03:	Engine is ignited, but can not be started	
	Possible causes of trouble	Remedy
Fuel delivery system:		
1)fuel inlet pipe pressure <250kPa <ul style="list-style-type: none">- Fuel in fuel tank is insufficient- Fuel filter is blocked- Fuel inlet pipe leaks- Fuel pressure regulator is damaged- Fuel pump pressure is insufficient- Fuel evaporability is incorrect	1) <ul style="list-style-type: none">- Replenish fuel- Replace fuel filter- Replace fuel inlet pipe- Replace fuel pressure regulator- Replace fuel pump- Use fuel with suitable evaporability according to seasons	
Idle speed control system:		
1)Stepping on the gas can start <ul style="list-style-type: none">- Idle speed valve plug scaling off- Idle speed valve plug terminals do not correspond to ECM terminals- Idle speed valve is blocked- ECM constant power supply is interrupted- Idle speed valve is damaged- ECM is faulty	1) <ul style="list-style-type: none">- Reconnect- Repair wire bundle- Clean flow regulating valve body- Repair wire bundle- Replace idle speed valve- Replace ECM	
Intake/exhaust system:		
1)Air filter is blocked	1)Clean intake passage, replace filter element	
2)Three-way catalytic converter is blocked <ul style="list-style-type: none">- Catalytic converter is damaged- Blocked by burnt foreign matters	2) <ul style="list-style-type: none">- Replace three-way catalytic converter- Repair engine, replace three-way catalytic converter	

Fault 04:	Idle speed is abnormal	
Possible causes of trouble	Remedy	
1) Vehicle power supply is turned off, and system is powered for the first time	1) Turn of ignition switch, restart after 10s	
2)ECM constant power supply is interrupted when vehicle is stopped	2) Resume ECM constant power supply	

Fault 05:	Idle speed is lower	
Possible causes of trouble	Remedy	
1) Idle speed valve plug scaling off	1) Reconnect	
2) Idle speed valve plug terminals do not correspond to ECM terminals	2) Repair wire bundle	
3) Idle speed valve hole is blocked	3) Clean flow regulating valve body	
4) Idle speed valve is damaged	4) Replace idle speed valve	
5) Fuel in fuel tank is insufficient	5) Replenish fuel	
6) Fuel filter is blocked	6) Replace fuel filter	
7) Fuel inlet pipe leaks	7) Replace fuel inlet pipe	
8) Three-way catalytic converter is blocked	8) Replace catalytic converter, and repair engine if necessary	
9) Intake system is blocked	9) Clean intake passage, Replace filter element	
10)fuel pressure regulator is damaged	10) Replace fuel pressure regulator	
11)fuel pump pressure is insufficient	11) Replace fuel pump	
12)ECM is faulty	12) Replace ECM	

Fault 06:	Idle speed is high	
Possible causes of trouble	Remedy	
1) Conforms to target idle speed - Water temperature sensor reading is abnormal - Water temperature sensor reading is normal	1) - Replace water temperature sensor - Normal phenomenon	
2) Does not conform to target idle speed - Throttle position does not return to its original position - Idle speed valve step distance <5 steps -intake pipe leaks; idle speed control system is faulty - 5 steps <idle speed valve step distance <150 steps -idle speed control system is faulty	2) - Adjust throttle cable - Remove fault of intake pipe leakage; idle speed control system is faulty, refer to "Idle speed is low" - Idle speed control system is faulty, refer to "Idle speed is low"	

Fault 07:	Idle speed is unstable	
Possible causes of trouble	Remedy	
1) Spark plug lead is not connected properly	1) Reconnect	
2) Spark plug clearances are not the same	2) Adjust all of them to 1.0~1.2mm	
3) Fuel pressure regulator vacuum tube is disconnected or damaged	3) Check and repair or replace vacuum tube	
4) Some nozzles are blocked	4) Clean or replace faulty nozzles	
5) 58x ring gear is dislocated	5) Ensure that the falling edge of No. 20 tooth is top dead center of cylinders 1 & 4	

Fault 08:	Engine flames out suddenly in normal operation	
	Possible causes of trouble	Remedy
	1) Power supply system is not connected properly	1) Check all relevant connectors in power supply positive/negative pole circuits
	2) Fuel in fuel tank is insufficient	2) Replenish fuel
	3) Fuel inlet pipe leaks	3) Replace fuel inlet pipe

Fault 09:	Engine flames out at deceleration	
	Possible causes of trouble	Remedy
	1) ECM constant power supply is interrupted when stopping the vehicle	1) Resume ECM constant power supply
	2) Idle speed valve plug terminals do not correspond to ECM terminals	2) Repair wire bundle
	3) Idle speed valve is blocked	3) Clean flow regulating valve body
	4) Idle speed valve is damaged	4) Replace idle speed valve
	5) ECM is faulty	5) Replace ECM

Fault 10:	Engine works abnormally when stepping on the gas	
	Possible causes of trouble	Remedy
	1) Throttle position or manifold pressure sensor terminal is faulty	1) Repair wire bundle

Fault 11:	Acceleration is weak or delayed	
	Possible causes of trouble	Remedy
	1) Intake system is not smooth	1) Clean intake passage, replace air filter element
	2) Intake manifold pressure sensor hole is blocked	2) Clean intake manifold pressure sensor detection hole, and replace if necessary sensor
	3) Throttle can not be opened fully	3) Adjust throttle stop screw, ensure that throttle is fully open
	4) Nozzle is blocked	4) Clean or replace faulty nozzle
	5) Exhaust system is not smooth	5) Check and repair exhaust system and three-way catalytic converter

Fault 12:	Engine power is insufficient	
	Possible causes of trouble	Remedy
	1) Intake system is not smooth	1) Clean intake passage, replace air filter element
	2) Throttle can not be opened fully	2) Adjust throttle stop screw, ensure that throttle is fully open
	3) Exhaust system is not smooth	3) Check and repair exhaust system and three-way catalytic converter
	4) Power transmission system resistance is too high	4) Check parts and assemblies related to repair power transmission system
	5) Engine is overheat	5) Check and repair engine cooling system
	6) Nozzle is blocked	6) Clean or replace faulty nozzle

Fault 13:	Rotating speed is unstable in traveling	
	Possible causes of trouble	Remedy
	1) Ignition system high-tension circuit leaks	1) Reconnect all connector, replace damaged parts
	2) Nozzle is blocked	2) Clean or replace faulty nozzle

XI Electric System

Fault 14:	Shudder in acceleration
Possible causes of trouble	Remedy
1) Ignition system high-tension circuit leaks	1) Reconnect all connector, replace damaged parts

Fault 15:	Detonation
Possible causes of trouble	Remedy
1) Fuel is unqualified 2) Engine is overheated 3) 58x ring gear is dislocated	1) Use fuel with Octane number higher than 90 2) Check and repair engine cooling system 3) Ensure that the falling edge of No. 20 tooth is top dead center of cylinders 1 & 4

Fault 16:	After burning (and exhaust temperature is too high)
Possible causes of trouble	Remedy
1) Engine ignition system has the problem of loss of cylinder 2) Engine exhaust valve is faulty 3) 58x ring gear is dislocated	1) Immediately resume ignition of the lost cylinder. The cylinder can not be resumed, disconnect the control plug of the cylinder nozzle, so as to protect three-way catalytic converter 2) Repair engine 3) Ensure that the falling edge of No. 20 tooth is top dead center of cylinders 1 & 4

Fault 17:	Emission is found out of specification in loaded mode
Possible causes of trouble	Remedy
1) Engine state is abnormal 2) Electric injection system control is abnormal 3) Connector from cylinder head to three-way catalytic converter leaks air 4) Oxygen sensor thread leaks air 5) Fuel pressure regulator vacuum tube is disconnected 6) Fuel pressure regulator is faulty 7) Three-way catalytic converter and oxygen sensor are out of their service life 8) Three-way catalytic converter and oxygen sensor are damaged due to heavy metal poisoning or overheat 9) Three-way catalytic converter and oxygen sensor are poisoned from sulfur 10) ECM or electric injection system grounding is poor 11) ECM casing is grounded 12) 58x ring gear is dislocated	1) Check and repair engine 2) Check and repair electric injection system as per Test Run procedures and Test Technical Conditions for 462/465 Series Vehicles 3) Tighten relevant bolts, and replace washers if necessary 4) Tighten oxygen sensor 5) Check and repair or replace 6) Replace fuel pressure regulator 7) Under normal operating conditions, service life is over 80,000km, and replace if necessary 8) Replace catalytic converter and oxygen sensor 9) Drive the vehicle at 3 rd gear and 70km/h speed for 10min 10) Correct system grounding position 11) Insulate ECM casing 12) Ensure that the falling edge of No. 20 tooth is top dead center of cylinders 1 & 4

Fault 18:	Emission is found out of specification in short loaded mode
Possible causes of trouble	Remedy
1) Vehicle is not fully warmed up 2) Miscellaneous	1) Warm up engine 2) Refer to Exhaust Emission Test in Loaded Mode

Fault 19:	CO and HC density is too high at idle speed	
	Possible causes of trouble	Remedy
	1) Vehicle is not fully warmed up	1) Warm up engine, make high idle speed test first
	2) Miscellaneous	2) Refer to Exhaust Emission Test in Loaded Mode

Faulty 20:	Fuel evaporative emission is abnormal	
	Possible causes of trouble	Remedy
	1) Charcoal canister communicating pipe is damaged	1) Replace communicating pipe
	2) Charcoal canister is damaged	2) Replace charcoal canister
	3) Charcoal canister is too small	3) Use suitable charcoal canister
	4) Charcoal canister solenoid valve wiring harness is faulty	4) Repair wire bundle
	5) Connector is not connected properly	5) Reconnect
	6) Charcoal canister solenoid valve is damaged	6) Replace charcoal canister solenoid valve
	7) ECM is faulty	7) Replace ECM

Fault 21:	Fuel consumption is abnormal	
	Possible causes of trouble	Remedy
	1) Method of measurement is incorrect	1) Adopt reliable method of measurement
	2) Vehicle state	2) Check and repair vehicle
	3) Engine state	3) Check and repair engine
	4) Thermostat is damaged	4) Replace thermostat
	5) Coolant temperature sensor is faulty	5) Replace coolant temperature sensor
	6) Electric injection system state	6) Check and repair electric injection system as per Test Run procedures and Test Technical Conditions for 462/465 Series Vehicles
	7) Nozzle leaks	7) Replace damaged nozzle
	8) Fuel pressure regulator is damaged	8) Replace regulator
	9) Oxygen sensor is faulty	9) Replace oxygen sensor
	10) ECM is faulty	10) Replace ECM

Fault 22:	Air conditioner system related faults are indicated on vehicles without air conditioners	
	Possible causes of trouble	Remedy
	1) Electric injection system air conditioner control provisional plug is contaminated	1) Clean air conditioner provisional plug, take proper measures for dust and water protection, turn off electric power to ECM for 10 min

Fault 23:	ECM is locked by anti-theft device	
	Possible causes of trouble	Remedy
	1) Anti-theft device related wiring harness is faulty	1) Repair wiring harness
	2) Connector is not connected firmly	2) Reconnect
	3) Anti-theft key is damaged	3) Replace and learn new anti-theft key
	4) Decoding is required	4) Return ECM to Delphi to decode
	5) Miscellaneous	5) Get in touch with anti-theft device supplier

Fault 24:	Anti-theft key is lost or anti-theft device is damaged	
	Possible causes of trouble	Remedy
	1) Anti-theft key is lost or anti-theft device is damaged	1) Get in touch with anti-theft device supplier, or return ECM to Delphi to decode

Fault 25:	Fault indicator lamp comes on and off irregularly while vehicle is running	
	Possible causes of trouble	Remedy
	1) Connector is not connected properly	1) Check all plug terminals of electric injection system, and reconnect all connectors

Automobile Lamping, Instrument and Accessory Electric Devices

1 Automobile lamping system

Lamping system specifications

Lamping system specifications are as listed in Table below:

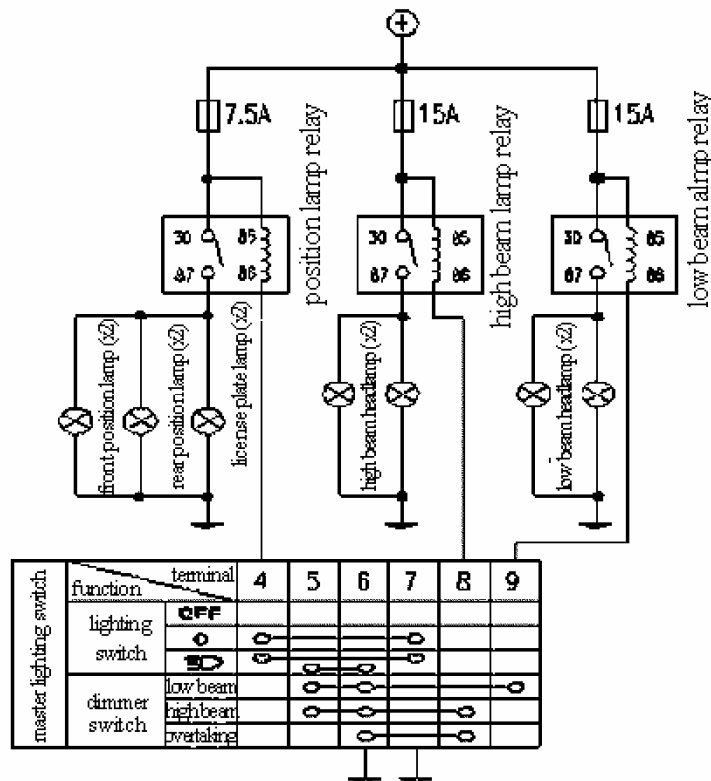
Description	Specifications (W)	Description	Specifications (W)
High beam headlamp	55	Rear steering lamp	21
Low beam headlamp	55	Back-up lamp	21
Front position lamp	5	Rear fog lamp	21
Front steering lamp	21	License plate lamp	5
Front fog lamp	55	Reading lamp	10X2
Side steering lamp	5	Dome lamp	10
Rear position lamp	5	Door lamp	5
Brake lamp	21		

Check and repair of lamping system

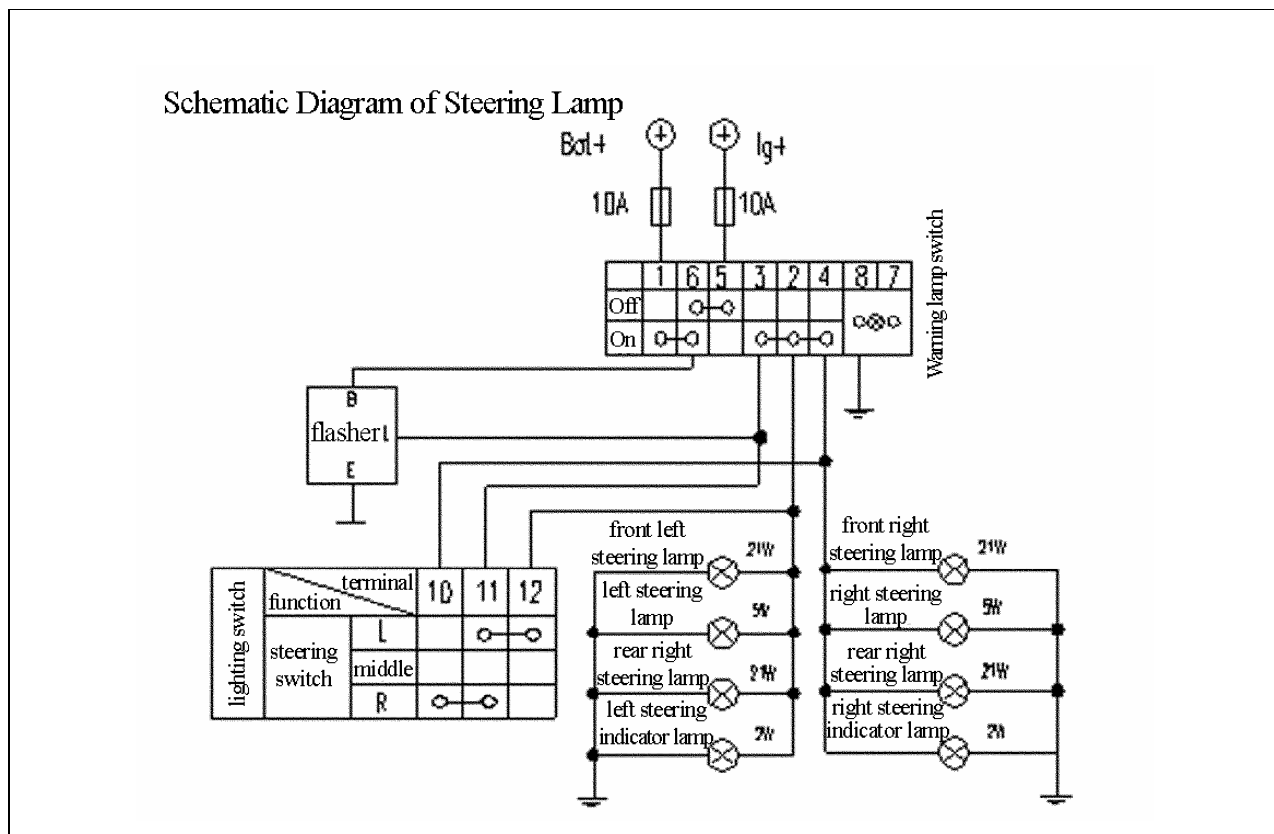
(1) Check and repair of Combination headlamp

Combination headlamps include high beam headlamp, low beam headlamp, front position lamp and front steering lamp.

- ① The following is schematic circuit diagram of high beam headlamp, low beam headlamp and front position lamp.



The following is the schematic circuit diagram of front steering lamp



② Check and repair of headlamp, position lamp and steering lamp

1) Headlamp does not come on

- Check if headlamp fuse is burnt;
- Check if headlamp relay operates normally;
- Check if headlamp bulb is burnt;
- Check if connector of circuit is in good contact.
- Check if dimmer switch (multi-function switch) conducts normally;
- Check if wiring harness is open or shorted.

2) Position lamp does not come on

- Check if position lamp fuse is burnt;
- Check if position lamp relay operates normally;
- Check if position lamp bulb is burnt;
- Check if connector of circuit is in good contact.
- Check if dimmer switch (multi-function switch) conducts normally;
- Check if wiring harness is open or shorted.

3) Steering lamp

a. Steering lamp and hazard warning lamp do not come on

- Flasher relay is damaged;
- Warning lamp switch is damaged;
- Circuit is open.;
- Warning lamp and coil fuse is burnt.

b. Steering lamp does not illuminate, but hazard warning lamp comes on

- Coil fuse is burnt;
- Warning lamp switch is damaged;
- Circuit is open.;
- Steering switch is faulty.

c. Only one side steering lamp does not come on

- Check if bulb is burnt;
- Steering switch is faulty;
- Check if connector of circuit is in good contact;
- Check if wiring harness is open or shorted.

d. Only hazard warning lamp does not come on

- warning lamp switch is faulty. (As for removal and installation of warning lamp switch, refer to Diagram of Removal of Rear Defrost switch)

③ Removal and installation of combination headlamp (see diagram):

1) Removal of combination headlamp

Remove middle screen and front bumper (as for removal of middle screen, refer to Section 61 of Manual of Parts and Assemblies, and as for removal of front bumper, refer to Section 27 of Manual of Parts and Assemblies);

Use screwdriver to remove installation screw, remove combination headlamp by pulling it to the forward direction of vehicle;

Disconnect connection of socket cable and vehicle wiring harness;

Remove cover plates 5, 6;

Remove socket cable 10;

Remove bulbs 7, 8, 9 (if it only necessary to replace bulbs, there is no need to remove lamp body).

2) Installation of combination headlamp

Install bulb into socket cable 10;

Install bulb with socket cable onto lamp body 3;

Snap on cover plates 5, 6;

Connect socket cable to vehicle wiring harness;

Align locating pin of combination headlamp with the locating hole in headlamp plate, and push combination headlamp backward;

Tighten installation screw.

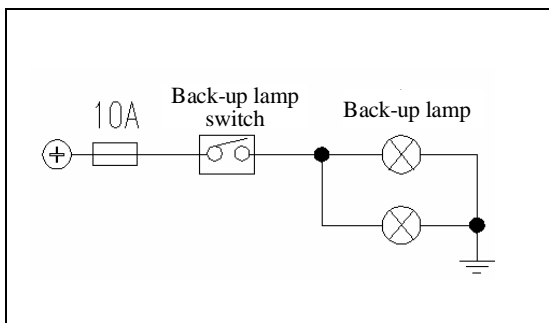
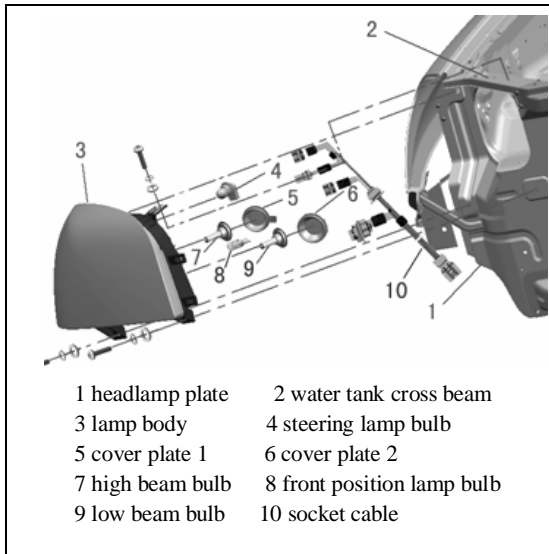
(2) Check and repair of rear combination lamp

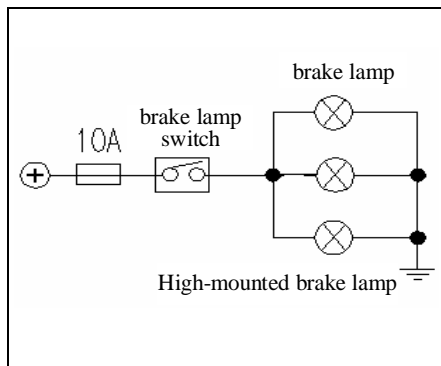
Rear combination lamps include rear position lamp, back-up lamp, and rear steering lamp and brake lamp.

① As for schematic diagram of rear position lamp circuit, see precious "Schematic Circuit Diagram of High Beam Headlamp, Low Beam Headlamp and Front position lamp";

The following is the schematic circuit diagram of back-up lamp:

As for schematic circuit diagram of rear steering lamp, see previous "Schematic Circuit Diagram of Front Steering Lamp";





The following is the schematic circuit diagram of brake lamp:

② Check and repair of rear combination lamp

1) As for check and repair of rear position lamp and rear steering lamp, see “Check and Repair of Headlamp, Position Lamp and Steering Lamp”.

2) Causes of troubles of back-up lamp

A. Causes that back-up lamp do not come on

- Back-up lamp bulb is burnt;
- Instrument fuse is burnt;
- Back-up switch is damaged;
- Circuit or connector is open or shorted.

B. Causes that back-up lamp illuminates all the time

- Back-up switch is broken internally;
- Circuit is shorted or wrongly connected, resulting in abnormal conduction.

3) Causes of troubles of brake lamp

A. Causes that brake lamp do not come on

- Brake lamp bulb is burnt;
- Brake fuse is burnt;
- Brake switch is damaged;
- Circuit or connector is open or shorted.

B. Causes that brake lamp illuminates all the time

- Brake lamp switch is shorted internally;
- Brake lamp switch is improperly installed;
- Circuit is shorted or wrongly connected, resulting in abnormal conduction.

③ Removal and installation of rear combination lamp (see diagram)

1) Removal of rear combination lamp:

Use screwdriver to remove installation screw of rear combination lamp, remove rear combination lamp 2 by pulling it to the back of the automobile body;

Disconnect connection of socket cable and vehicle wiring harness;

Disconnect socket cable 3;

Remove bulbs 4, 5, 6.

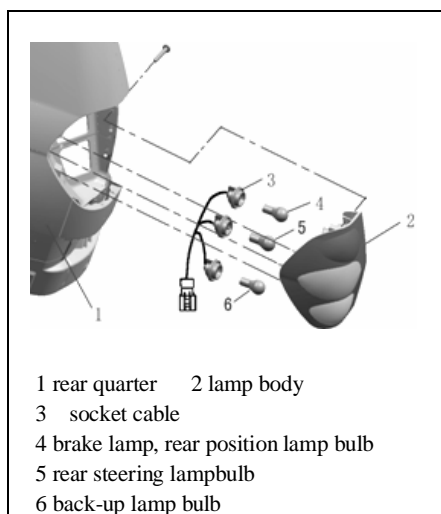
2) Installation of rear combination lamp:

Install bulbs 4, 5, 6 into socket 3;

Install socket on lamp body 2;

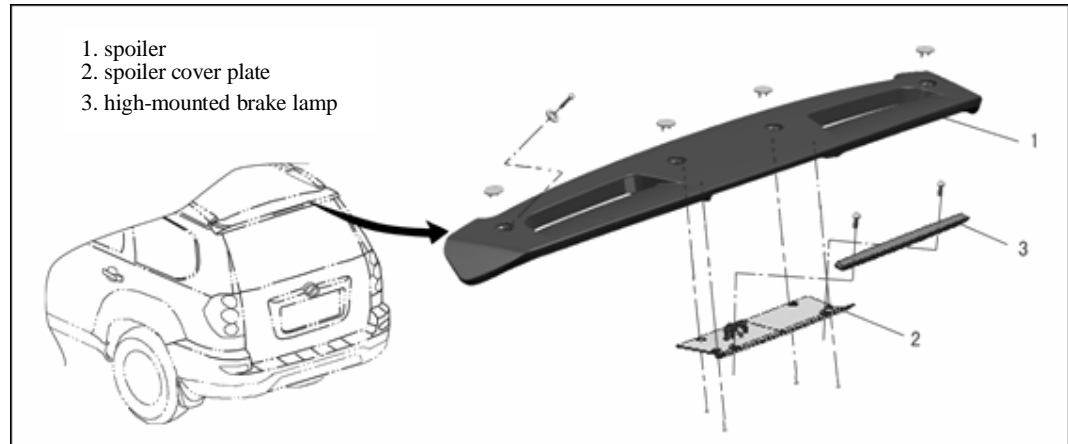
Connect socket cable to vehicle wiring harness;

Push rear combination lamp into quarter panel 1, insert locating pin into locating hole in quarter panel, and use screwdriver to tighten screw.



(3) Check and repair of high-mounted brake lamp

- ① As for circuitry of high-mounted brake lamp, see previous “Schematic Circuit Diagram of Brake Lamp”.
- ② As for check and repair of high-mounted brake lamp, refer to description in Paragraph of “Causes of Troubles of Brake Lamp”.
- ③ As for removal and installation of high-mounted brake lamp, see diagram below:



- 1) Removal of high-mounted brake lamp:
Remove spoiler and spoiler cover plate;
Disconnect electrical connector;
Use screwdriver to remove installation screw of high-mounted brake lamp, and remove high-mounted brake lamp by pulling it upwards.
- 2) Installation of high-mounted brake lamp:
Use screw to install high-mounted brake lamp on spoiler;
Install spoiler cover plate;
Connect electrical connector;
Install spoiler.

(4) Check and repair of side steering lamp

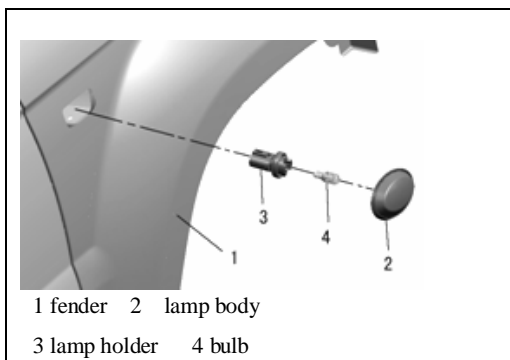
- ① As for circuitry of side steering lamp, refer to “Schematic Circuit Diagram of Steering Lamp”.
- ② As for check and repair of side steering lamp, refer to descriptions in Paragraph of “Check and Repair of Head Lamp, Position Lamp and Steering Lamp”.
- ③ Removal and installation of side steering lamp (see diagram).

1) Removal of side steering lamp

Remove side steering lamp by pushing it forward or backward;
Disconnect connection of socket and vehicle wiring harness (care should be taken to prevent wiring harness from retracting back into automobile body hole);
Remove side steering lamp socket 3;
Remove bulb 4.

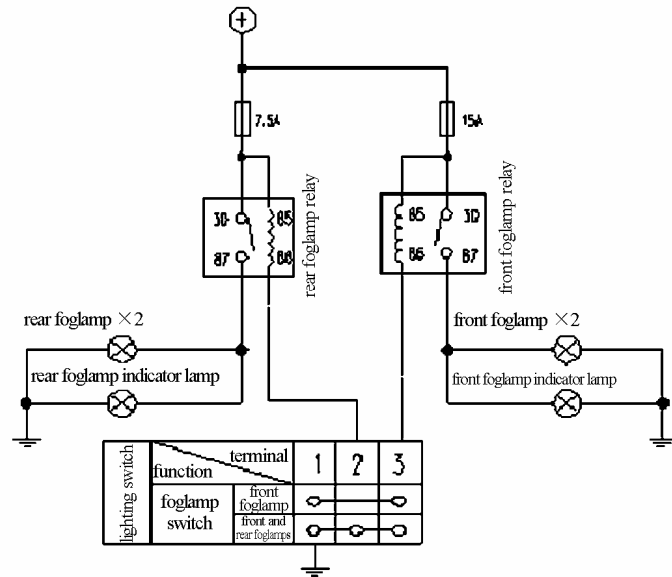
2) Installation of side steering lamp:

Insert bulb 4 into socket 3;
Install socket on lamp body 2;
Connect socket to vehicle wiring harness;
Insert side steering lamp into fender 1 installation hole, making the hook of side steering lamp engage with the fender.



(5) Check and repair of fog lamp

① The circuitry of fog lamp is as shown in the diagram below.



② Causes of troubles of fog lamp

1) Front fog lamp does not come on

Front fog lamp fuse is burnt;

Front fog lamp relay is damaged;

Front fog lamp bulb is damaged;

Circuit is open.

Front fog lamp switch (combination lamps lighting switch) is damaged.

2) Rear fog lamp does not come on

Rear fog lamp fuse is burnt;

Rear fog lamp relay is damaged;

Rear fog lamp bulb is damaged;

Circuit is open;

Rear fog lamp switch (combination lamps lighting switch) is damaged.

3) Front rear fog lamp illuminates all the time

Fog lamp relay is shorted or damaged internally;

Fog lamp switch (inside of combination lamps lighting switch) is shorted internally;

Circuit is shorted.

③ Removal and installation of fog lamp

1) Removal of front fog lamp (see diagram)

Remove front bumper (as for removal of front bumper, refer to Section 27 of Manual of Parts and Assemblies);

Use screwdriver to remove installation screw, and remove it by pulling it rearward of the vehicle;

Disconnect connection of blanking cap cable and vehicle wiring harness;

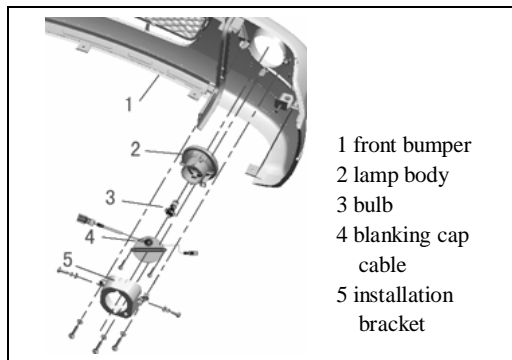
Remove front fog lamp blanking cap 4;

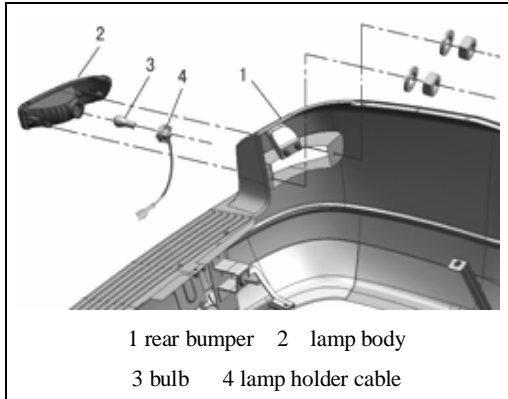
Remove bulb 3.

2) Installation of front fog lamp:

Install bulb 3;

Install blanking cap 4;





Connect blanking cap cable to vehicle wiring harness;
Push front foglamp into installation position on bumper, and tighten installation screw;
Install front bumper (as for installation of front bumper, refer to Section 27 of Manual of Parts and Assemblies).

3) Removal of rear foglamp(see diagram)

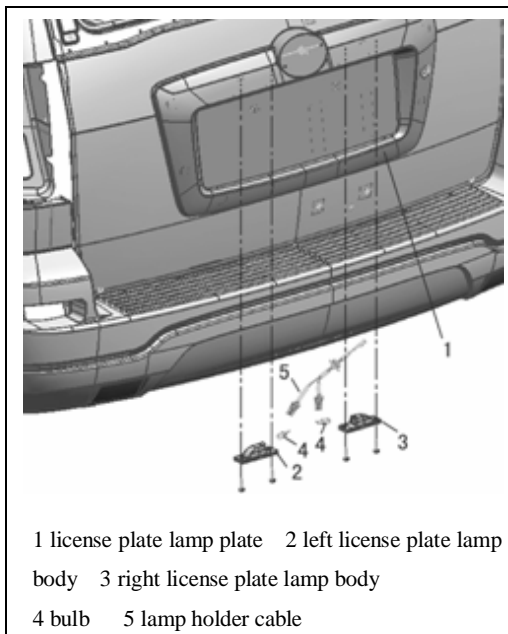
Remove rear bumper (refer to Section 38 of Manual of Parts and Assemblies);
Disconnect connection of lamp holder cable 4 and vehicle wiring harness;
Use wrench to remove installation nut of rear foglamp, and remove rear foglamp by pushing it backward;
Remove lamp holder cable 4;
Remove bulb 3.

4) Installation of rear foglamp

Install bulb 3 into socket 4;
Install socket on lamp body 2;
Connect lamp holder cable 4 and vehicle wiring harness;
Push rear foglamp into installation hole in rear bumper 1, and tighten nut;
Install rear bumper (refer to Section 38 of Manual of Parts and Assemblies).

(6) Check and repair of license plate lamp

- ① Schematic circuit diagram of license plate lamp (see “Schematic Circuit Diagram of High Beam Headlamp, Low Beam Headlamp and Front position Lamp”).
- ② As for causes of troubles of license plate lamp, refer to descriptions about position lamp in Paragraph of “Check and Repair of Headlamp, Position Lamp and Steering Lamp”.
- ③ Removal and installation of license plate lamp (see diagram)



1) Removal of license plate lamp:

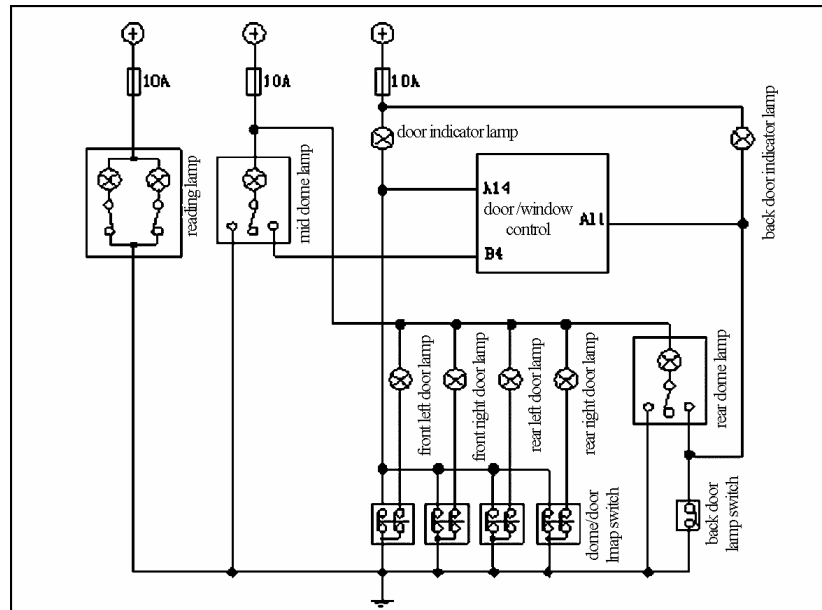
Use screwdriver to remove installation screw of rear license plate lamp, and pull license plate lamp downward;
Remove lamp body from bulb and lamp holder cable;
Remove bulb 4;
Remove back door interior trim panel;
Remove license plate lamp plate;
Remove lamp holder cable 5.

2) Installation of license plate lamp:

Connect lamp holder cable to vehicle wiring harness;
Install license plate lamp plate;
Install back door interior trim panel;
Install bulb 4 into socket 5;
Push license plate lamp body into installation hole in license plate lamp plate, and tighten screw.

(7) Check and repair of dome lamp and door lamp

- ① The schematic circuit diagram of dome lamp and door lamp is given below:



② Causes of troubles of dome lamp and door lamp

- 1) Dome lamp and door lamp do not come on
dome lamp fuse is burnt;
Circuit is open.
- 2) Dome lamp does not come on, but door lamp comes on
Dome lamp bulb is damaged;
Dome lamp wiring harness and main wiring harness are not connected properly;
Dome lamp connector is in poor contact.
- 3) Dome lamp is normal, but some door lamps do not come on
Door lamp bulb is damaged
Dome lamp wiring harness and main wiring harness are not connected properly;
Door lamp connector is in poor contact.
- 4) Dome lamp illuminates all the time (at OFF position)
Circuit is shorted to automobile body.
- 5) Dome lamp illuminates all the time (at Door position)
If all lamps of one door illuminate all the time, check the door lamp switch of that door;
Door lamp switch is grounded;
Door lamp switch circuit is shorted;
Check and repair the circuits of door lamp switch one by one. Any shorts to ground might result in permanent illumination of dome lamp and door lamp.

- 6) One door lamp illuminates all the time
Door lamp switch is grounded;
Door lamp switch circuit is shorted;
Check and repair the circuits of door lamp switch one by one. Any shorts to ground might result in permanent illumination of dome lamp and door lamp.
Relevant door lamp switch is damaged;
Relevant door lamp switch and main wiring harness are not connected properly.
- 7) Only dome lamp switch is out of function
Switch is faulty;
Dome lamp is not assembled properly, and its internal grounding to automobile body is in poor contact.

③ Removal and installation of dome lamp and door lamp

1) Removal of dome lamp (as show in diagram)

- Remove lamp house 4 by using screwdriver to pry it up;
- Remove bulb 3;
- Use screwdriver to remove four installation screw of dome lamp, and remove dome lamp body 2;
- Disconnect electrical connector.

2) Installation of dome lamp

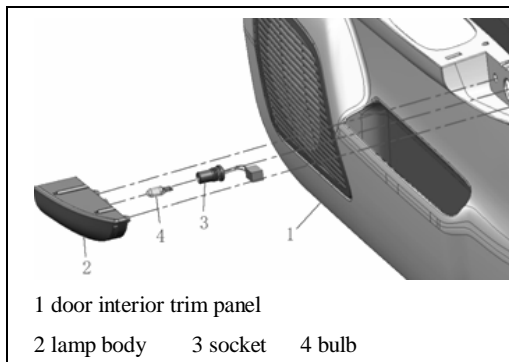
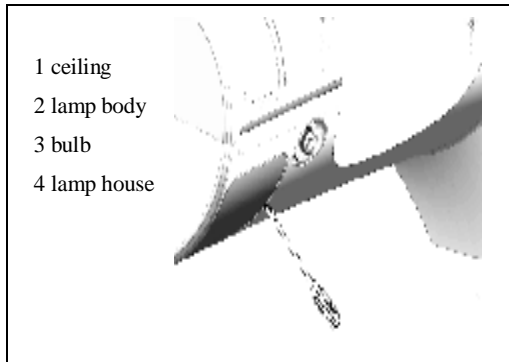
- Connect electrical connector;
- Install dome lamp body 2 on ceiling, and tighten installation screw;
- Install bulb 3;
- Snap on lamp house 4.

3) Removal of door lamp: (as show in diagram)

- Remove door interior trim panel 1 (refer to Section 53 of Manual of Parts and Assemblies);
- Disconnect connection of socket 3 and vehicle wiring harness;
- Grip installation clamp of door lamp from the back of interior trim panel, and remove door lamp by pushing it outward;
- Remove door lamp socket 3;
- Remove bulb 4.

4) Installation of door lamp: (as shown in previous diagram)

- Install bulb 4 into socket 3;
- Install door lamp socket 3 on lamp body;
- Push door lamp into installation position 1 on interior trim panel, and snap the clamp into installation hole;
- Connect socket 3 to vehicle wiring harness;
- Installation door interior trim panel 1.



(8) Reading lamp

- ① As for circuitry of reading lamp, refer to “Schematic Circuit Diagram of Dome Lamp and Door Lamp”.
- ② Causes of troubles of reading lamp.
 - 1) Reading lamp does not come on
Check if Radio-player fuse is burnt;
Circuit is open.

2) Reading lamp illuminates all the time.

Reading lamp is grounded internally.

3) Reading lamp at one side comes on, and that at the other side does not.

Bulb of reading lamp not coming on is damaged;

Circuit is open internally;

Switch of reading lamp not coming on is in poor contact.

③ Removal and installation of reading lamp (as show in diagram)

1) Removal of reading lamp

Remove electric roof window switch by using screwdriver to pry it up;

Use screwdriver to remove installation screw of reading lamp, and remove the reading lamp by pulling it downward;

Disconnect electrical connector;

Remove lamp house 4 by using screwdriver to pry it up;

Remove bulb 5.

2) Installation of reading lamp:

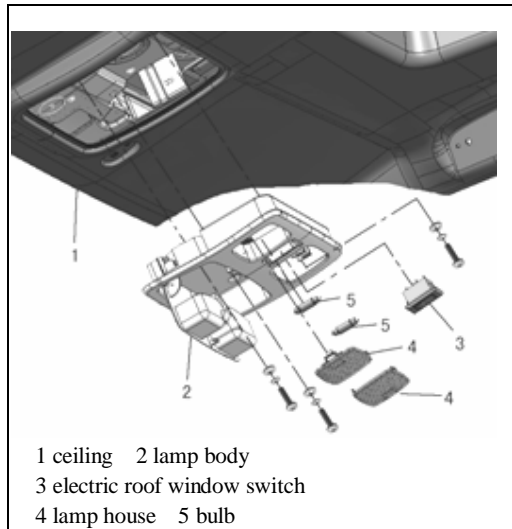
Install bulb 5 on reading lamp body 2;

Snap on lamp house 4;

Connect electrical connector;

Install reading lamp on the ceiling 1, and use screwdriver to tighten screw;

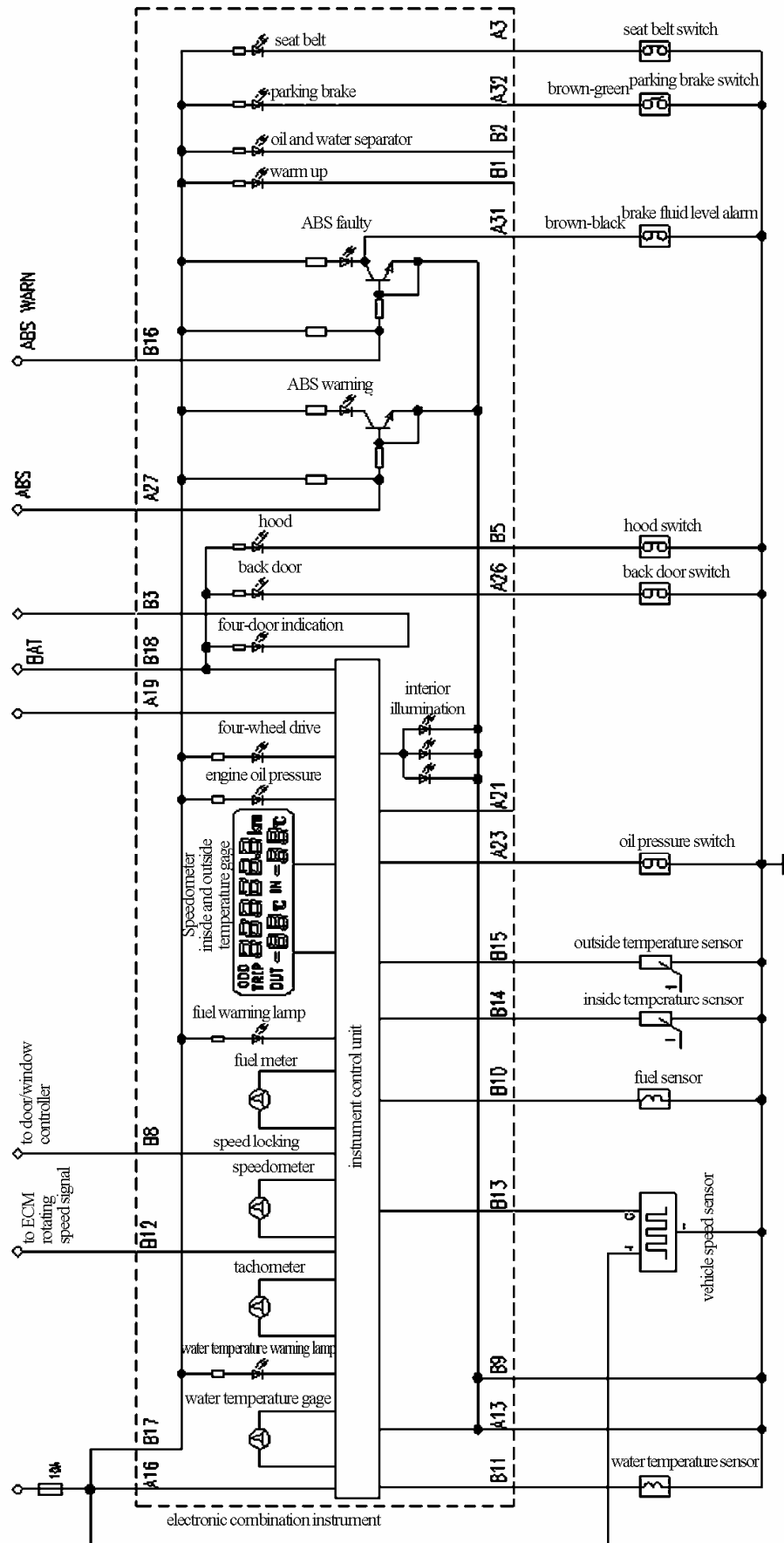
Install electric roof window switch 3.



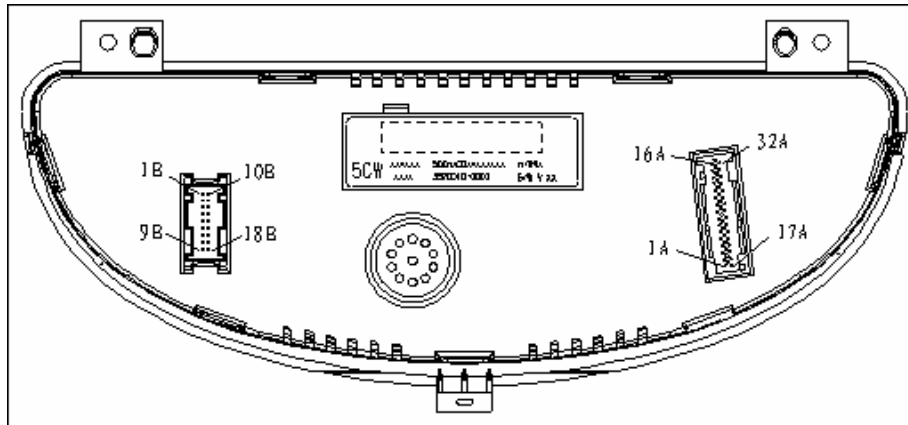
2 Combination instrument

Combination instrument circuit

The circuitry of combination instrument is as shown in the diagram below.



Pins of electrical connector of combination instrument are defined as in diagram below.



Check and repair of combination instrument

- (1) Combination instrument is out of function (various instruments have no response)

Instrument fuse is burnt;
Wiring harness is not connected properly;
Circuit is open.

- (2) Water temperature gage or fuel gage is faulty

Disconnect sensor connector, and short the signal terminal to ground. If instrument needle swings towards maximum value direction, it indicates that both circuit and instrument are normal; otherwise, check the connection of circuit and the condition of instrument;

Move fuel sensor float up and down, sensor resistance should change within 60ohm to 110ohm;

Under the condition of 50°C to 125°C temperatures, water temperature sensor resistance should change within 10ohm to 160ohm.

- (3) Tachometer is faulty

Instrument and electric injection system computer (ECU or ECM) connecting circuit is open.

- (4) Automobile speedometer is faulty

Automobile speed sensor is damaged;
Automobile speed sensor circuit is open.

- (5) Instrument background lighting is faulty

External circuit is open;
Instrument is faulty internally.

- (6) Instrument audio warning is faulty

First check if various warning lamps operate normally;
Instrument is faulty internally.

- (7) Instrument indicator lamp does not come on

Indicator lamp is damaged;
External circuit is open.

- (8) Inside/outside temperature gage is faulty

- 1) Display is blank

Combination instrument is damaged, LCD is out of function.

- 2) Displayed temperature is appreciably too high or is too low

Displayed temperature is too high (instrument indicates "H");
sensor or circuit is shorted internally;

Displayed temperature is too low (instrument indicates “L”), sensor is or circuit is open internally;

(9) Instrument and warning lamp self test

If instrument is out of function partially, it can be determined quickly if it is the problem of the instrument by using the self test function of the instrument.

Self functional diagnosis mode is entered by setting ignition switch at ON position and quickly depressing the zero resetting liver of the speedometer for 3 times in succession (at an interval of less than 1s). Self diagnosis contents are list in the following Table:

Self-test code (LCD)	Function	Procedures	LCD	Diagnosis of state
00	LCD display	After 00 is selected, wait about 1s	All sectors	All sectors of LCD come on
01	Automobile speedometer	After 01 is selected, wait about 1s	01	Normal, automobile speedometer needle returns to 60Km/h after full range deflection
02	Tachometer	After 02 is selected, wait about 1s	02	Normal, tachometer needle returns to 3000rpm after full range deflection
03	Fuel gage	After 03 is selected, wait about 1s	03	Fuel quantity gage displays once every 2s in the following order: F-1/2-E-F
04	Temperature gage	After 04 is selected, wait about 1s	04	Water temp. gage displays once every 2s in the following order: H-1/2-C-H
05	Buzzer	After 05 is selected, wait about 1s	05	Continuously on, normal
06	Low-fuel level warning lamp	After 06 is selected, wait about 1s	06	Low-fuel level warning lamp flashes 3 times, normal
07	High-fuel level warning lamp	After 07 is selected, wait about 1s	07	High-fuel level warning lamp flashes 3 times, normal

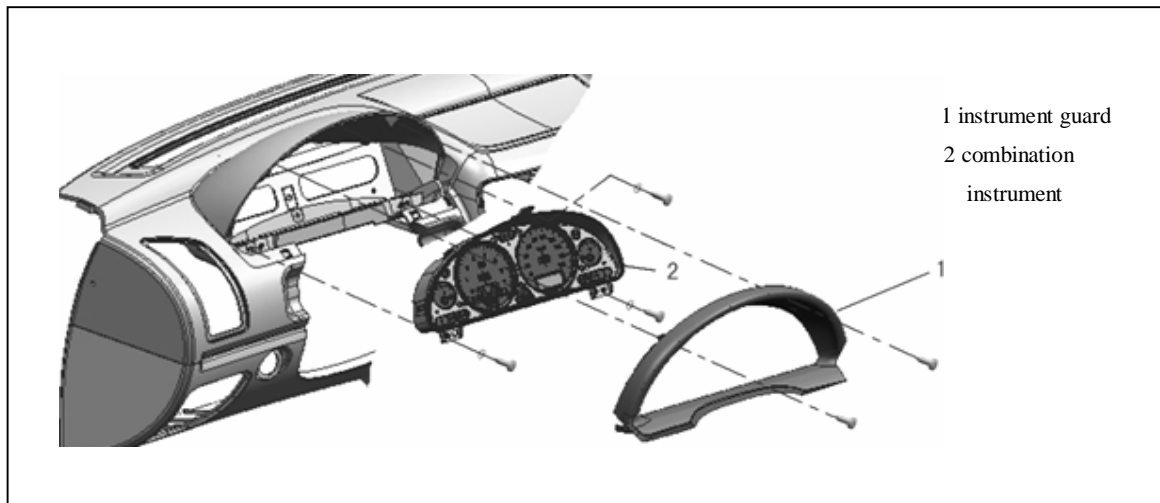
Notes: ① Test codes DTC are displayed in the order of from small number to big number cyclically;

② Test codes can be quickly read by pressing and holding the accumulate/sum-up switch for a time longer than 1s;

③ After entering new test code DTC mode, previous mode will be cancelled.

Removal and installation of combination instrument

(1) Removal and installation of combination instrument (see diagram)



1) Removal of combination instrument

Use screwdriver to remove 2 installation screws of instrument guard 1, and remove the instrument guard by pulling it to the rearward direction of vehicle (refer to Section 37 of Manual of Parts and Assemblies);

Remove 3 installation screws of combination instrument, and remove the combination instrument 2 by pulling it to the forward direction of vehicle;

Disconnect electrical connector, and remove combination instrument.

2) Installation of combination instrument

Connect electrical connector onto combination instrument 2;

Align the locating hole of combination instrument with the instrument locating pin on the instrument panel, and use screwdriver to tighten installation screw;

Snap on instrument guard 1, and tighten installation screw.

(2) Removal and installation of fuel sensor (see diagram)

1) Removal of fuel sensor

Fold the seats of the second row up forward, open access panel on floor carpet, and use screwdriver to remove fuel sensor hole cover plate;

Remove installation screw of fuel sensor ;

Pull fuel sensor upward, disconnect electrical connector, and remove fuel sensor.

2) Installation of fuel sensor

Connect electrical connector of fuel sensor to chassis wiring harness;

Align the 5 screw installation holes of fuel sensor with thread holes in fuel tank, and tighten by means of screws;

Install fuel sensor hole cover plate;

Reposition the seat.

(3) Removal and installation of water temperature sensor (see diagram)

1) Removal of water temperature sensor

Disconnect connection of water temperature sensor and engine wiring harness;

Use wrench to remove water temperature sensor.

2) Installation of water temperature sensor

Use wrench to install and tighten water temperature sensor on the engine;

Connect water temperature sensor connector of engine wiring harness to water temperature sensor.

(4) Removal and installation of automobile speed sensor (see diagram)

1) Removal of Automobile speed sensor

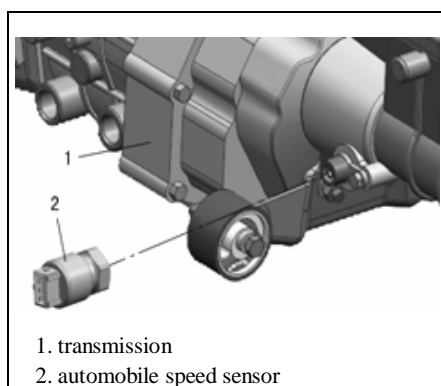
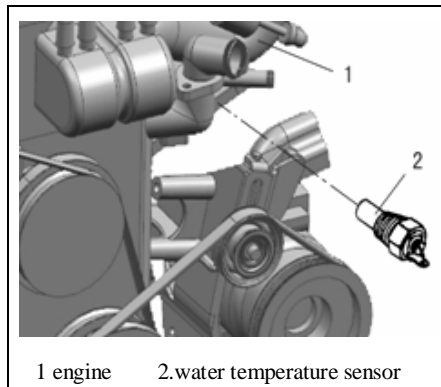
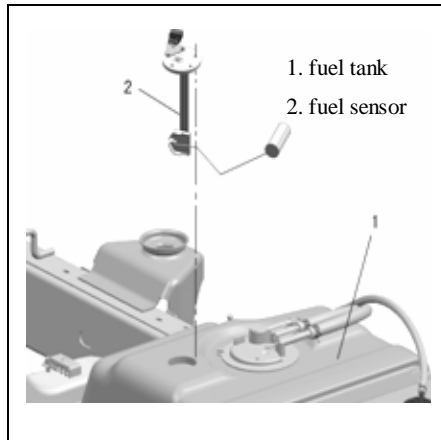
Disconnect connection of automobile speed sensor and chassis wiring harness;

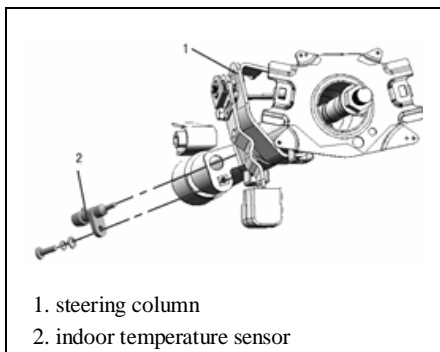
Use wrench to remove automobile speed sensor.

2) Installation of Automobile speed sensor

Use wrench to install and tighten automobile speed sensor on transmission;

Connect automobile speed sensor connector on chassis wiring harness to automobile speed sensor.





(5) Removal and installation of sensor (see diagram)

1) Removal of indoor temperature sensor

Remove multi-function switch upper and lower cover plates;

Disconnect electrical connector;

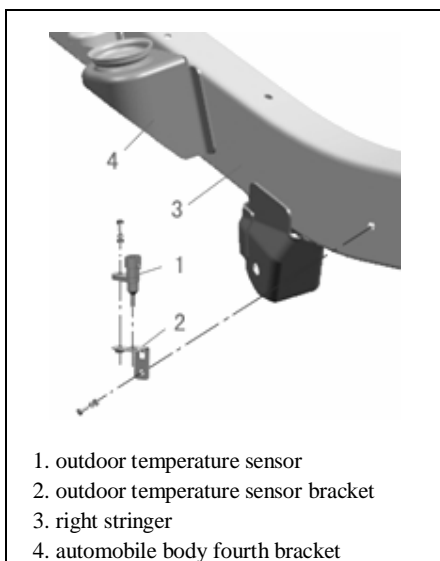
Use screwdriver to remove installation screw of temperature sensor 2, and remove the temperature sensor by pulling it downward.

2) Installation of indoor temperature sensor

There is an indoor temperature sensor installation bracket on steering column 1. insert the head of indoor temperature sensor 2 into bracket hole, and use screwdriver to tighten installation screw;

Connect electrical connector;

Installation multi-function switch upper and lower covers.



(6) Removal and installation of outdoor temperature sensor (see diagram)

1) Removal of outdoor temperature sensor

Disconnect electrical connector;

Use screwdriver to remove installation of screw of outdoor temperature sensor 1, and remove outdoor temperature sensor by pulling it upward;

2) Installation of outdoor temperature sensor

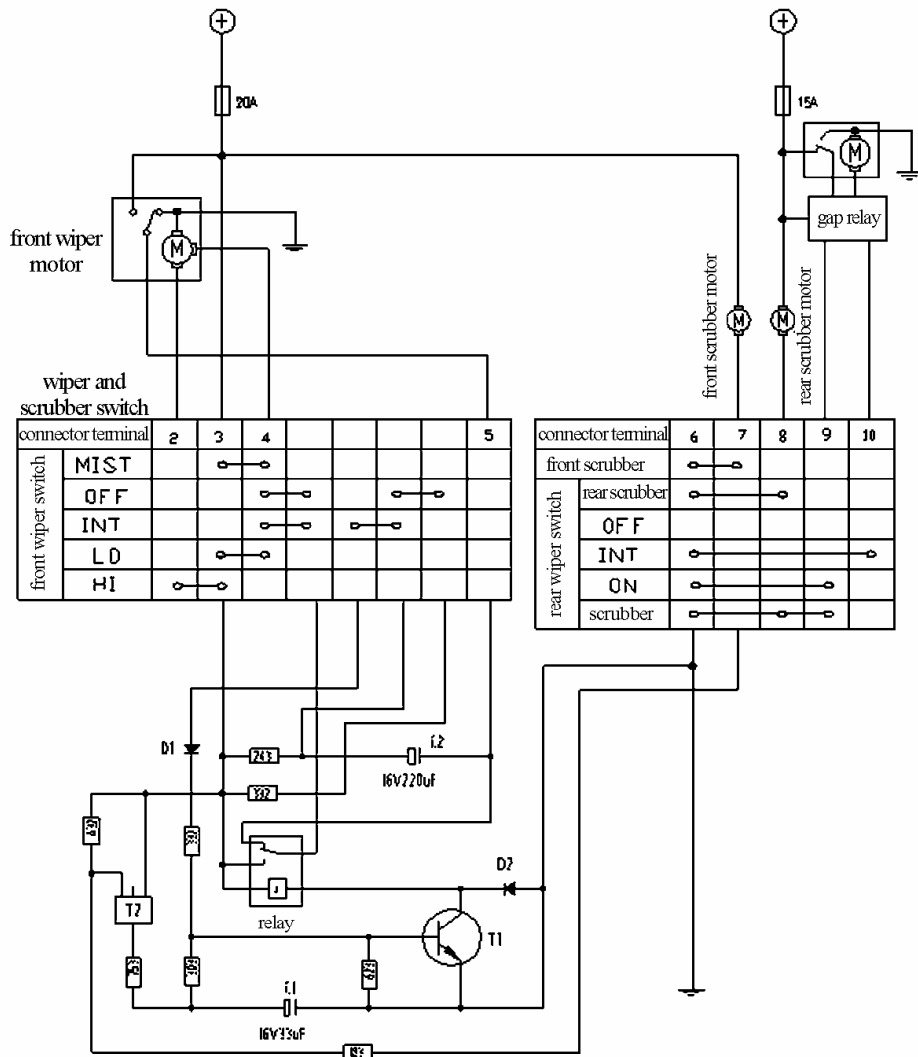
Insert the head of outdoor temperature sensor 1 into outdoor temperature sensor bracket hole, and use screwdriver to tighten installation screw;

Connect electrical connector.

3 automobile accessories

Wiper and scrubber

(1) The following is the schematic circuit diagram of wiper and scrubber.



Schematic Circuit Diagram of Wiper and Scrubber

(2) Causes of troubles of wiper and scrubber

1) Both wiper and scrubber do not move

Wiper fuse is burnt;

Multi-function switch is open internally;

Multi-function switch connector is in poor contact;

Circuit is open.

- 2) Both wiper and scrubber do not move
 - Multi-function switch is open internally;
 - Multi-function switch connector is in poor contact;
 - Wiper or scrubber connector is in poor contact;
 - Wiper motor or scrubber motor is damaged.
- 3) Wiper does not return to its original position
 - Wiper intermittent device (inside multi-function switch) is damaged;
 - Circuit is open or connector is in poor contact;
 - Wiper motor is faulty internally.
- 4) Wiper works without intermittence
 - Wiper intermittent device (inside multi-function switch) is damaged;
 - Wiper intermittent switch (inside multi-function switch) is damaged;
 - Circuit is open.
- 5) Wiper works without high speed or low speed
 - Wiper motor is faulty;
 - Multi-function switch is open internally;
 - Multi-function switch connector is in poor contact;
 - Circuit is open.

(3) Removal and installation of wiper and scrubber

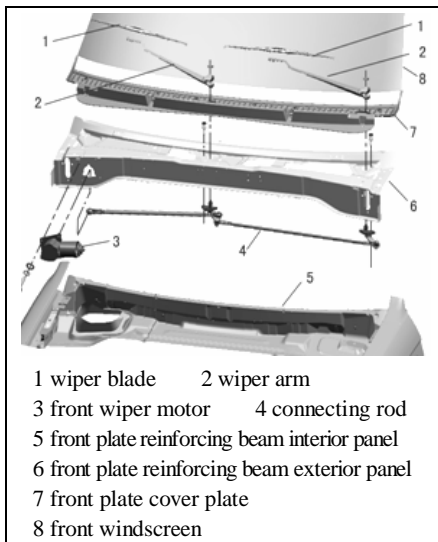
① Removal and installation of front wiper (as show in diagram)

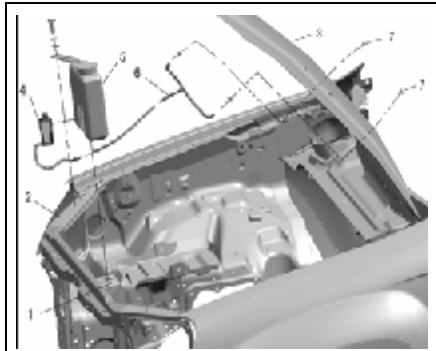
1) Removal of front wiper

Use wrench to remove installation screw on wiper arm, and remove the wiper arm by pulling it upward;
 Remove wiper blade from wiper arm hook;
 Disconnect electrical connector, use wrench remove four installation screws of front wiper motor, pull wiper motor to forward direction of vehicle, disconnect connection of connecting rod, and remove the wiper motor;
 Remove front cover plate;
 Use wrench to remove 6 installation screws of connecting rod, and remove connecting rod (refer to Section 102 of Manual of parts and Assemblies).

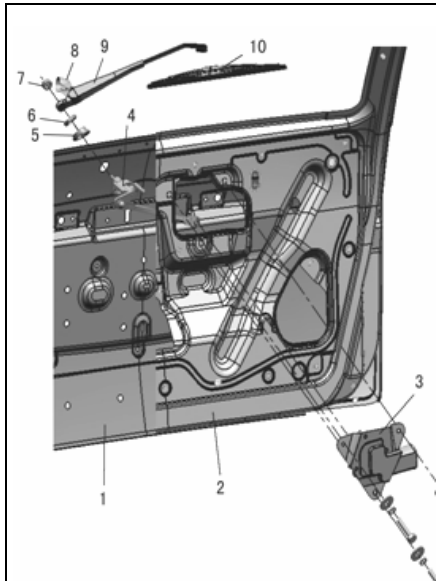
2) Installation of front wiper:

Install connecting rod, and torque installation screw to 13N.m;
 Install shaft joint of connecting rod into shaft bushing of motor;
 Use screw install motor onto reinforcing beam exterior panel of front plate;
 Connect motor electrical connector to automobile body wiring harness;
 Install wiper arm of connecting rod into installation hole in front plate reinforcing beam exterior panel, and tighten installation of screw of connecting rod;
 Install front plate cover plate;
 Install wiper blade on wiper arm hook;
 Install wiper arm on connecting rod, and tighten it by means of screw.





1 battery support plate
2 headlamp cross beam 3 hood
4 scrubber motor 5 fluid reservoir
6 hose 7 nozzle



1. back door exterior panel
2. back door interior panel
3. rear wiper motor
4. Connecting rod 5. retainer
6. nut 7. nut 8. wiper arm cap
9. wiper arm 10. wiper blade

② Removal and installation of front scrubber (see diagram)

1) Removal of front scrubber

Remove installation screw of fluid reservoir , and remove fluid reservoir by pulling it upward;

Disconnect electrical connector;

Disconnect connection of hose to fluid reservoir and nozzle;

Remove scrubber motor from fluid reservoir;

Use wrench to remove installation of nut nozzle, and remove the nozzle by pulling it to the top of hood;

2) Installation of front scrubber

Install nozzle, and use wrench to tighten nut;

Push scrubber motor into fixing seat on fluid reservoir;

Connect electrical connector;

Install fluid reservoir, with its lower locating pin inserted into the locating hole in battery support plate, and use wrench to tighten installation screw;

Connect hose.

③ Removal and installation of rear wiper (see diagram)

1) Removal of rear wiper

Remove back door interior trim panel;

Remove wiper blade 10 from rear wiper hook;

Use wrench to remove installation of nut 7 from wiper arm, and remove wiper arm;

Use wrench to remove installation screw from wiper motor, pull rear wiper motor forward, disconnect electrical connector, disconnect connection of and connecting rod, and remove wiper motor;

Remove securing nut 6 and retainer 5 from connecting rod output shaft, and remove connecting rod.

2) Installation of rear wiper

Insert wiper arm installation shaft of connecting rod into installation hole in back door exterior panel;

Install shaft joint of connecting rod into shaft bushing in motor;

Use screw to install motor on back door interior panel;

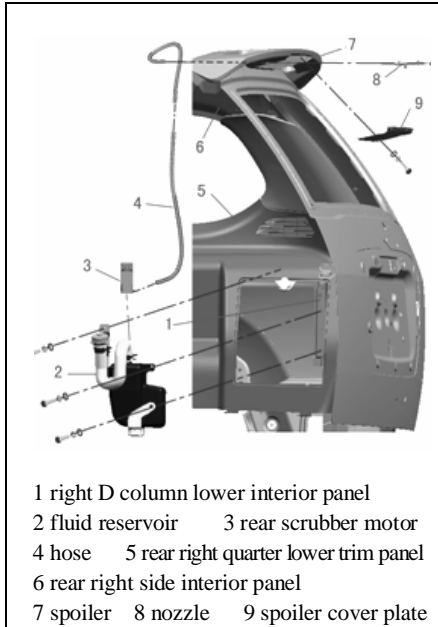
Connect motor electrical connector to automobile body wiring harness;

Install retainer 5 on wiper arm installation shaft of connecting rod, and use wrench to install securing nut 6;

Install wiper arm on connecting rod, and use nut 7 to tighten;

Install wiper blade 10 on wiper arm hook;

Install interior trim panel.



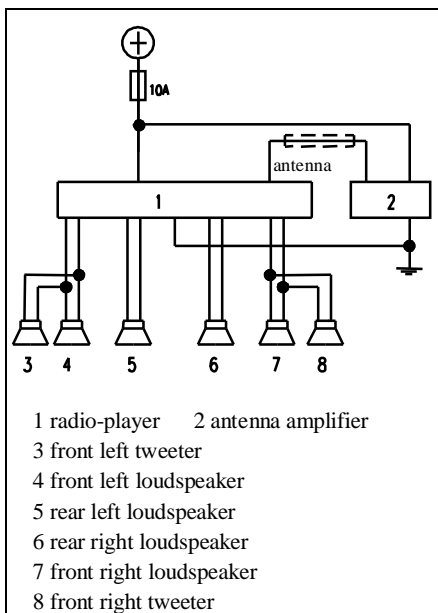
④ Removal and installation of rear scrubber (see diagram)

1) Removal of rear scrubber

Remove installation screw of fluid reservoir, and remove fluid reservoir by pulling it inboard of automobile body;
Disconnect connection of fluid reservoir and automobile body wiring harness;
Disconnect connection of fluid reservoir and hose;
Remove scrubber motor from fluid reservoir;
Remove spoiler, and disconnect connection of nozzle and hose;
Remove spoiler cover plate;
Remove installation screw of nozzle, and remove nozzle by pulling it backward.

2) Installation of rear scrubber

Install nozzle, and tighten installation screw;
Install spoiler cover plate;
Pass hose through rear right side interior panel, with its lower end extending to fluid reservoir installation position, and its upper end extending out from right quarter panel exterior panel into spoiler and connected to the nozzle;
Push scrubber motor into fixing seat on fluid reservoir;
Connect motor electrical connector to automobile body wiring harness;
Connect hose to motor;
Install fluid reservoir, and tighten installation screw.



Audio system

(1) The circuitry of audio system is as shown in diagram below.

(2) Causes of troubles of audio system

1) Radio-player does not work

Memory is locked or radio-player fuse is burnt;
Internal fuse of audio-player is burnt;
Radio-player is damaged;
Circuit is open.

2) Radio reception is abnormal

Antenna amplifier or antenna feeder is damaged;
Antenna amplifier or antenna feeder is poorly connected;
Antenna amplifier negative pole is not grounded;
Radio-player is faulty internally.

3) Playing is abnormal

Magnetic head or laser head is dirty;
Poor quality tape or disc is used;
Radio-player mechanism is faulty.

4) One loudspeaker does not work

The loudspeaker is damaged;
Connector is in poor contact;
Circuit is open.

(3) Removal and installation of audio system

① Removal and installation of radio-player (see diagram):

1) Removal of radio-player

Remove mid guard 2;

Use screwdriver to depress the spring tab on the side radio-player, and pull out radio-player 3;

Disconnect electrical connector.

2) Installation of radio-player:

Connect electrical connector;

Push radio-player 3 into radio-player fixing frame of instrument panel, allowing the spring tab on the side of radio-player to engage into the square hole in the fixing frame;

Snap on midguard 2.

② Removal and installation of antenna amplifier (see diagram)

1) Removal of antenna amplifier

Remove instrument panel and front right column A interior trim panel;

Use screwdriver to remove installation screw of antenna amplifier; Disconnect connection between antenna feeder and front windscreen printed antenna, and between radio-player and instrument panel electrical wiring harness;

Remove antenna feeder fixing clamp from instrument panel reinforcing beam, and remove antenna feeder and antenna amplifier.

2) Installation of antenna amplifier

Install antenna amplifier, and use screwdriver to tighten installation screw;

Connect antenna feeder and front windscreen printed antenna;

Install antenna feeder fixing clamp into fixing hole in instrument panel reinforcing beam;

Connect antenna feeder to wiring harnesses of radio-player and instrument panel;

Install instrument panel and front right column A interior trim panel.

③ Removal and installation of tweeter/bass loudspeakers (see diagram)

1) Removal of tweeter/bass loudspeaker

Remove side door interior trim panel;

Disconnect connection of bass loudspeaker and side door wiring harness;

Use screwdriver to remove installation screw of bass loudspeaker, and remove bass loudspeaker;

Use screwdriver to pry up the internal angle member;

Disconnect connection of tweeter and side door wiring harness;

Use screwdriver to remove installation screw of tweeter, and remove tweeter.

2) Installation of tweeter/bass loudspeaker

Install tweeter, and use screwdriver to tighten installation screws;

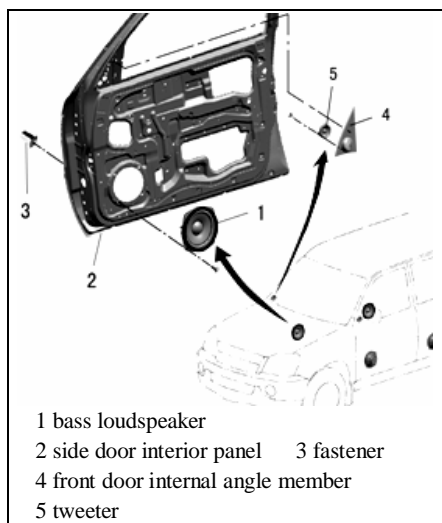
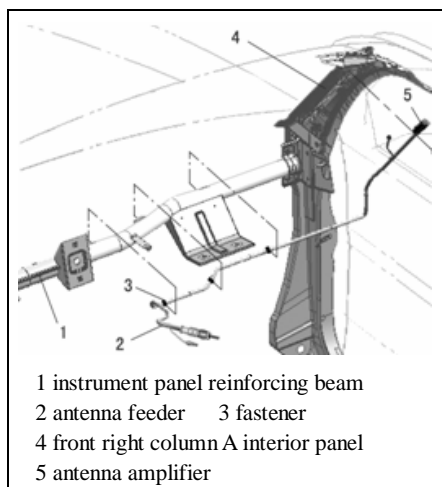
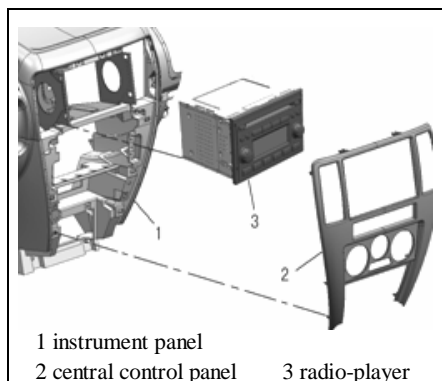
Connect tweeter electrical connector to door wiring harness;

Install internal angle member;

Install bass loudspeaker, and use screwdriver to installation screws;

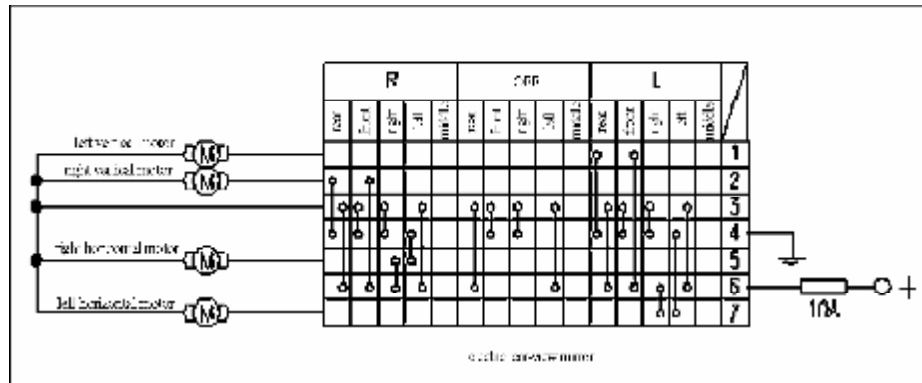
Connect electrical connector;

Install side door interior trim panel.



Electric rear-view mirror

(1) The circuitry of electric rear-view mirror is as shown in diagram below.



(2) Causes of troubles of electric rear-view mirror:

1) Electric rear-view mirror does not move

Fuse (coil fuse) is burnt;

Electric rear-view mirror switch is open internally;

Electric rear-view mirror switch connector is in poor contact;

Electric rear-view mirror is faulty;

Circuit is open.

2) Electric rear-view mirror does not work in vertical (or horizontal) direction

Electric rear-view mirror vertical motor (or horizontal motor) is damaged;

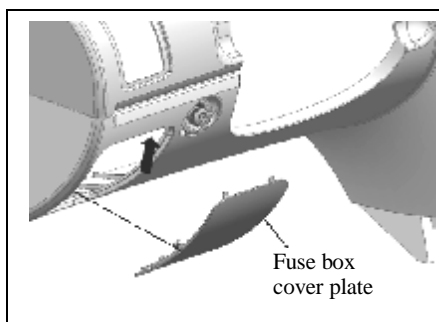
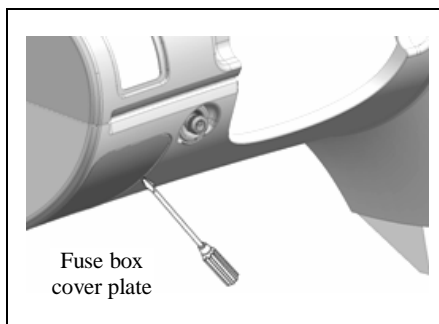
Electric rear-view mirror switch is open internally;

Circuit is open.

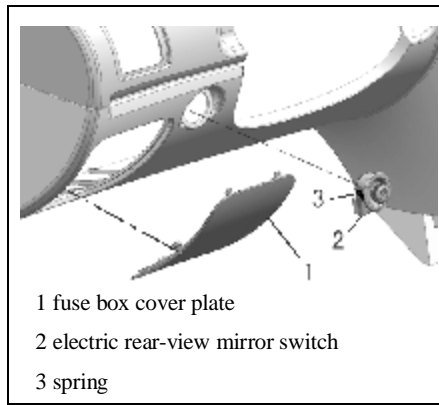
(3) Removal and installation of electric rear-view mirror switch

1) Removal of electric rear-view mirror switch

Insert screwdriver into the notch in fuse box cover plate, pry up fuse box cover plate, and remove fuse box cover plate (see diagram);



Put your hand from the position pointed by the arrow to behind the electric rear-view mirror switch, grip the spring piece, and push the electric rear-view mirror switch out;



Then, disconnect electrical connector, and remove electric rear-view mirror switch 2;

2) Installation of electric rear-view mirror switch:

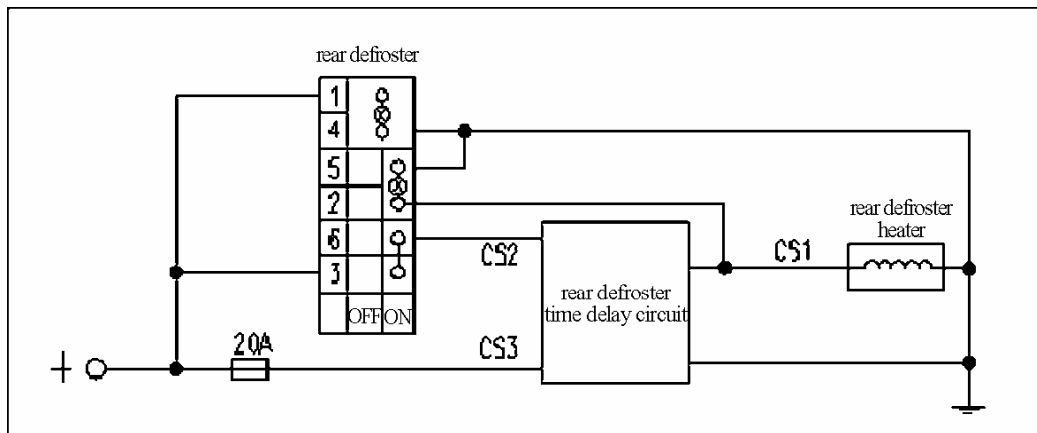
Connect electrical connector to electric rear-view mirror switch;

Align the locating pin at the lower edge of the electric rear-view mirror switch with electric rear-view mirror switch locating notch on the instrument panel, and push electric rear-view mirror switch into installation hole;

Installation of fuse box cover plate: align the two locating pawls on the top of the fuse box cover plate with corresponding notch on the instrument panel, and then gently tap the middle and lower part of fuse box to close the fuse box properly.

Rear defroster

(1) The circuitry of rear defroster is as shown in diagram below.



- 1) Rear defroster does not work
 - Rear defroster fuse is burnt;
 - Rear defroster heater is damaged
 - Rear defroster time delay relay is damaged;
 - Rear defroster switch is damaged or open;
 - Circuit is open.
- 2) Rear defroster is unable to terminate its operation
 - Rear defroster time delay relay is faulty internally.

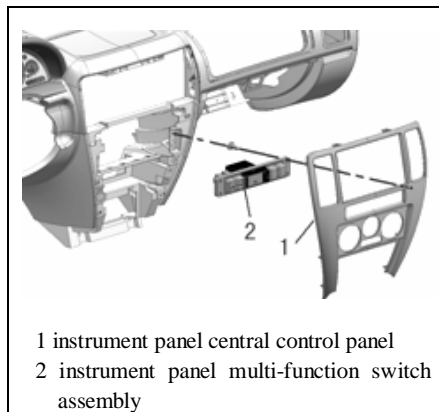
(3) Removal and installation of rear defroster switch

1) Removal of rear defroster switch

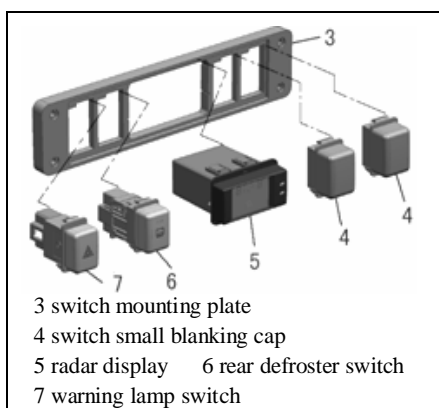
Gently pull both sides of lower part of instrument panel central control panel 1, then gently pull both ends of middle and upper parts of central control panel, and remove central control panel and instrument panel multi-function switch 2 assembly.

Disconnect all electrical connectors of instrument panel multi-function switch assembly 2;

Remove four installation screws of instrument panel multi-function switch assembly 2, and remove it from the central control panel;



(2) Causes of troubles of rear defroster:



Instrument panel multi-function switch assembly is composed of switch mounting plate 3, switch small blanking cap 4, radar display 5, rear defroster switch 6 and warning lamp switch 7. All parts are of snap-on type, and can be removed by using screwdriver.

2) Installation of rear defroster switch

Install rear defroster switch, warning lamp switch, radar display , switch small blanking cap on switch mounting plate at their original positions;

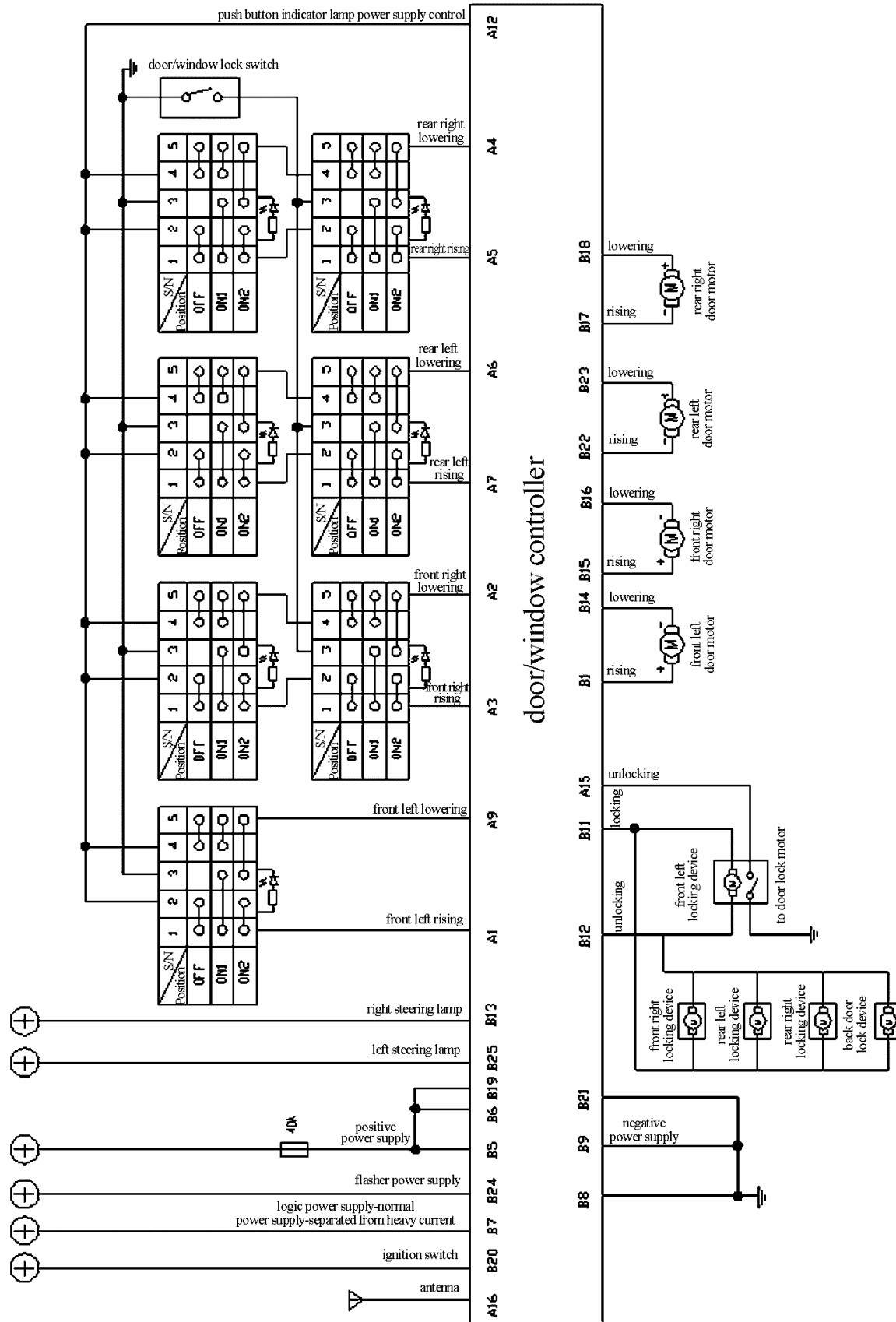
Push instrument panel multi-function switch assembly into installation hole of middle guard, and tighten it by using installation screws;

Connect electrical connector to the relevant switch;

Snap on central control panel.

Door/window controller, remote controller and door/window switch

(1) Circuitry of door/window switch is as shown in diagram below:



- (2) Door/window controller, remote controller and electric door/window switch failure
- ① Window glass lifting function failure
- 1) All lifting functions failed
Electric window fuse is burnt
Door/window controller is damaged
Circuit is open
 - 2) One certain door/window lifting function failed
Relevant electric door/window switch is damaged
Relevant electric glass lifter (motor) is damaged
Relevant circuit is open or connector is in poor contact
 - 3) One certain door/window glass can not be lifted, but window can be closed remotely.
Relevant electric door/window switch is damaged
Relevant circuit is open or connector is in poor contact
 - 4) One certain door/window glass can not be lifted, and window can not be closed remotely
Relevant electric glass lifter (motor) is damaged
Relevant electric glass lifter (motor) circuit is open or connector is in poor contact
Door/window controller is damaged
 - 5) One certain door/window can not be lifted or lowered
Relevant electric door/window switch is damaged
Relevant electric door/window switch circuit is open or connector is in poor contact
Relevant door/window controller input circuit is open or connector is in poor contact
 - 6) Windows can not be lowered automatically or closed remotely, but door can be locked remotely
Door/window controller is damaged
 - 7) Remote locking and window closing are defective
Remote controller is damaged or electric power is insufficient
Door/window controller internal reception circuit is damaged
- ② Central lock failure
- 1) Both manual unlocking and remote control functions failed
Memory fuse is burnt
Door/window controller is damaged
Circuit is open
 - 2) Manual unlocking (key unlocking and front left side door lock safety button unlocking) functions failed
Front left side door lock control switch is faulty
Door/window controller is damaged
Front left side door lock control switch circuit is open or connector is in poor contact
Door/window controller circuit is open or connector is in poor contact
 - 3) Only key unlocking function is defective or only front left side door lock safety button unlocking function is defective
Front left side door lock control switch mechanical device is damaged
 - 4) One certain door lock does not work
Relevant door lock release mechanism is damaged
Relevant door release mechanism electrical connector is in poor contact
Relevant door lock release mechanism circuit is open.

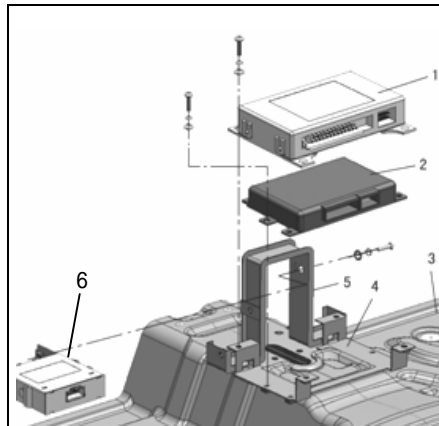
③ Mid dome lamp control failed

1) Under normal circumstances, mid dome lamp distinguishes in the form of dimming. If dimming mode has failed, it indicates that door/window controller is damaged;

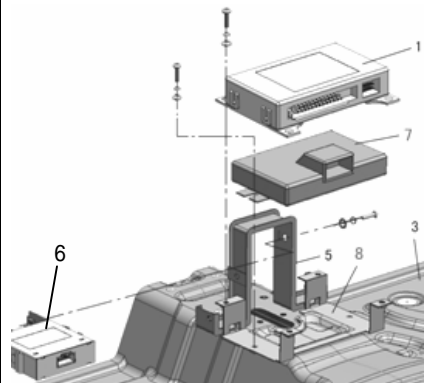
2) If dome lamp time-delayed distinguishing mode has failed, it indicates that door/window controller is damaged.

④ Remote anti-theft failure

If remote anti-theft function has failed and remote controller operates normally, it might indicate that door/window controller is damaged.



4×2-drive vehicle



4×4-drive vehicle

- 1. door/window controller 2. AT-ECU
- 3. front floor
- 4. door/window controller bracket (4×2)
- 5. central passage bracket
- 6. back-up radar controller
- 7. four-wheel drive controller
- 8. door/window controller bracket (4×4)

(3) Removal and installation of door/window controller

1) Removal of door/window controller (see diagram)

Remove central storage box ;

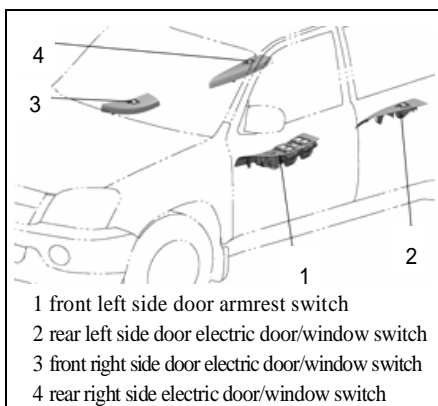
Use screwdriver to remove installation screw of door/window controller 1, disconnect electrical connector, and remove door/window controller 1 by pulling it upward;

2) Installation of door/window controller:

Connect electrical connector;

Install door/window controller 1 on door/window controller bracket 4 or 8, use screwdriver to tighten installation screws;

Install central storage box.

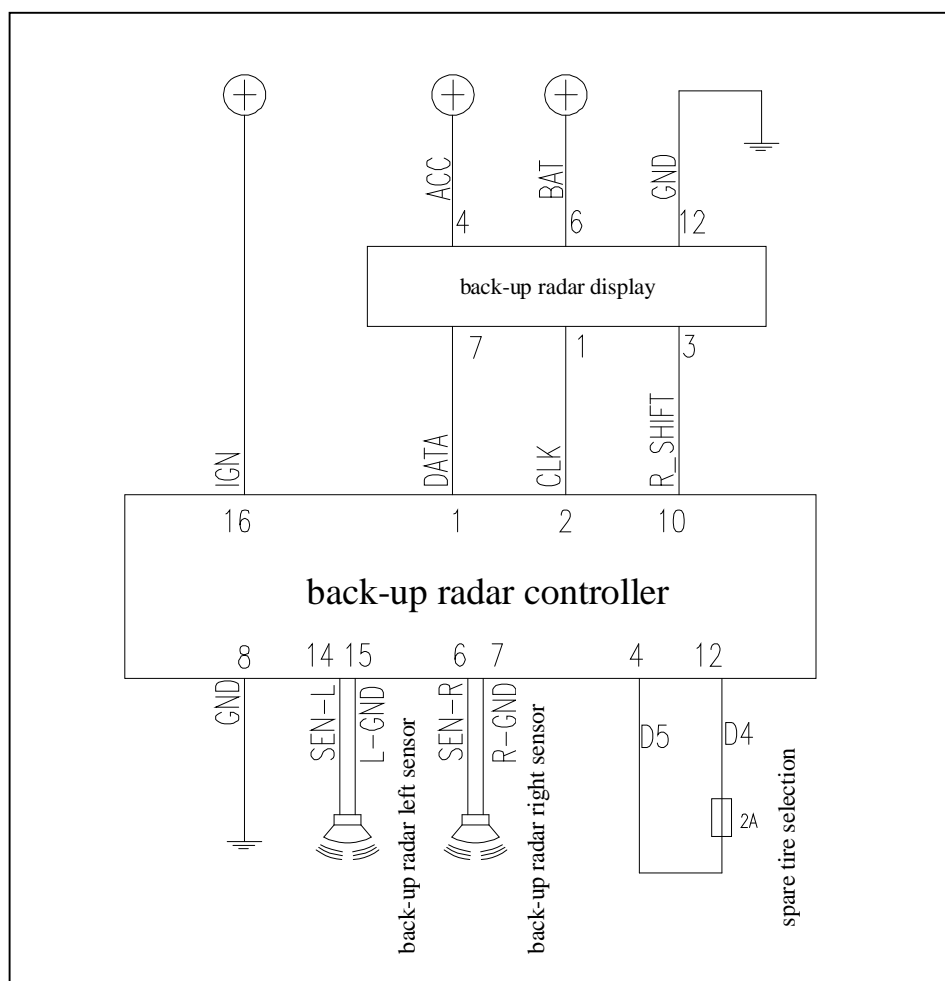


(4) Removal and installation of electric door/window switch

Electric door/window switches are located on four side doors, as shown in the diagram below, and can be removed by using screwdriver.

Back-up radar

(1) The circuitry of back-up radar is as shown in diagram below:



(2) back-up radar Causes of Trouble

- 1) Display does not indicate, but radar operates normally
 - Memory is locked or radio-player fuse is burnt
 - Display is damaged
 - Circuit is open

2) Display has clock indication but lost radar function indication

Back-up switch is damaged

Back-up switch circuit or radar controller power supply circuit is open.

Back-up radar controller is damaged

Back-up radar sensor is damaged

(3) Back-up radar self test

When shifting lever is changed to reverse gear, back-up radar controller enters into self-test mode. If both back-up radar left and right sensors function normally, buzzer sounds 1 bip and all LEDs do not come on; if one back-up radar sensor functions abnormally, buzzer sounds 2 bips, and the relevant LED flashes; and if both sensors function abnormally, buzzer sounds 3 bips, and all LEDs flash.

(4) Removal and installation of back-up radar

- ① As for removal and installation of back-up radar controller, refer to “Diagram of Removal of Door/Window Controller”.

1) Removal of back-up radar controller

Remove central storage box ;

Use screwdriver to remove installation screws of back-up radar controller 6, disconnect electrical connector, and remove back-up radar controller 6 by pulling it forward.

2) Installation of back-up radar controller

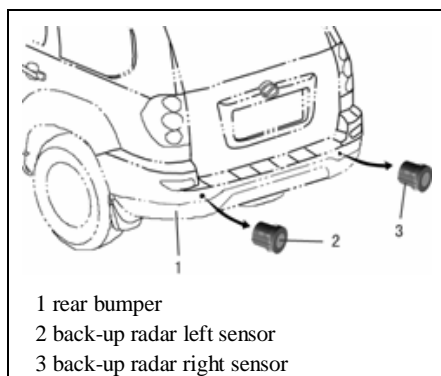
Connect electrical connector;

Install back-up radar controller 6 on central passage bracket 5, and use screwdriver to tighten installation screws;

Install central storage box.

- ② As for removal and installation of back-up radar display, refer to “Diagram of Removal and Installation of Rear Defroster Switch”.

- ③ As for removal and installation of back-up radar left and right sensors, refer to diagram below.



1) Removal of back-up radar left and right sensors

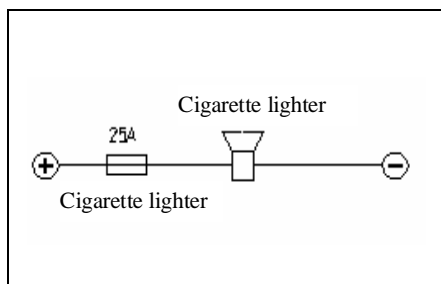
Use screwdriver pry up and remove back-up radar sensors;

Disconnect electrical connector.

2) Installation of back-up radar left and right sensors

Connect electrical connector;

Install back-up radar sensors on rear bumper 1.

**Cigarette lighter**

- (1) The circuitry of cigarette lighter is as shown in diagram below.

(2) Causes of trouble that cigarette lighter does not work

- 1) Cigarette lighter fuse is burnt;
- 2) Cigarette lighter is damaged;
- 3) Connector is in poor contact;
- 4) Wiring harness is open.

(3) Removal and installation of cigarette lighter

1) Removal of cigarette lighter (as show in diagram)

Pull out ash tray, press down the spring inside ash tray, and remove ash tray by pulling it backwrad;

Use screwdriver to pry up and remove central control panel;

Remove two fixing screws of ash tray exterior panel, and pull out ash tray exterior panel;

Disconnect connection of cigarette lighter and instrument panel wiring harness;

Remove cigarette lighter plug 4;

Push cigarette lighter socket 5 out from the back of ash tray exterior panel 7;

Push out cigarette lighter protective sleeve 6 out from back of ash tray exterior panel 7.

2) Installation of cigarette lighter

Install cigarette lighter protective sleeve 6 on ash tray exterior panel 7;

Insert cigarette lighter socket 5 into cigarette lighter protective sleeve 6;

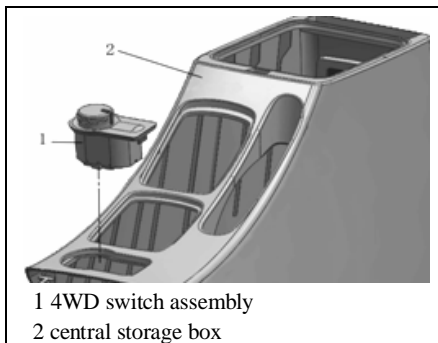
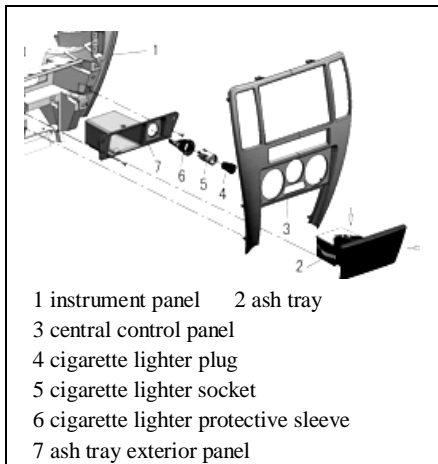
Plug cigarette lighter plug 4 into socket 5;

Plug in electrical connector;

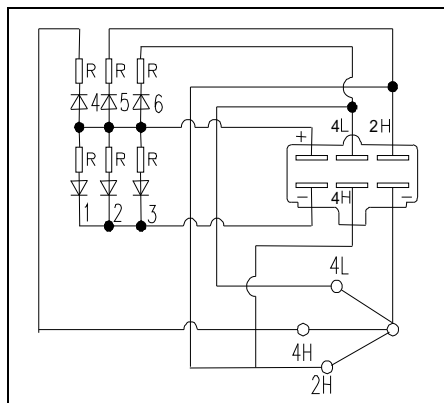
Install ash tray exterior panel, align locating hole with instrument panel locating column, and tighten installation screw;

Align plastic clip of central control panel with corresponding hole in instrument panel, and gently tap and make central control panel snap on instrument panel.

Hold the spring of ash tray, and push ash tray cover into ash tray exterior panel.



4WD switch assembly (as show in diagram)



(3) The control circuitry of 4WD switch is as shown in diagram below:

(4) 4WDswitch Inspection of and maintenance:

When control switch can not accomplish changeover of vehicle 2H, 4L and 4H drive modes, remove 4WD switch assembly from central passage, and check the conductivity of various positions of 4WD switch as per control circuitry. When the switch is found inconducive, replace the switch assembly.

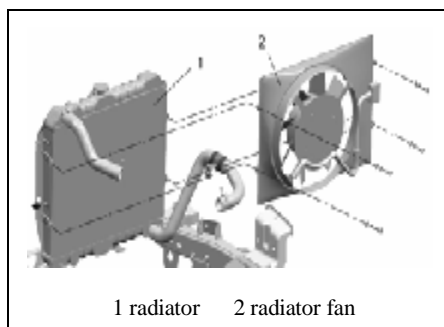
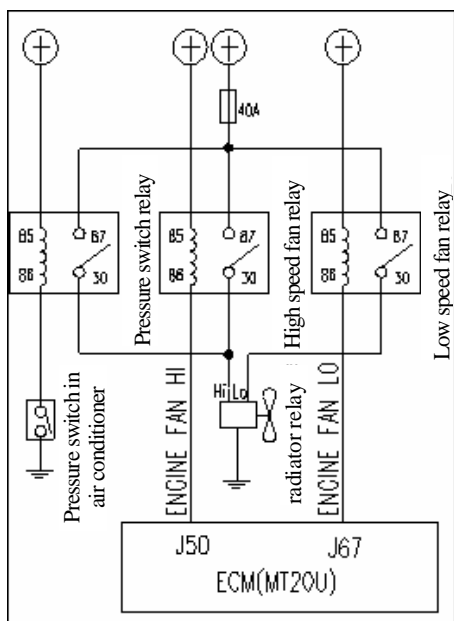
Radiator fan

(1) The circuitry of radiator fan is as shown in diagram.

(2) Causes of troubles

Before radiator water temperature reaches 93°C, radiator fan does not start. If it still does not work after water temperature is higher than 93°C, it indicates that radiator fan is faulty.

- 1) Fan does not work
Fan fuse is burnt;
Radiator fan connector is not plugged properly;
Radiator fan motor is damaged.
- 2) There is high speed, but no low speed
Low speed relay is damaged;
Radiator fan resistor is damaged
- 3) There is low speed, but no high speed
High speed relay is damaged.
- 4) When air conditioner is turned on, radiator fan high speed does not work
Refrigerating system has not reached specified pressure;
Pressure switch relay is damaged;
Pressure switch is damaged.



(3) Removal and installation of radiator fan

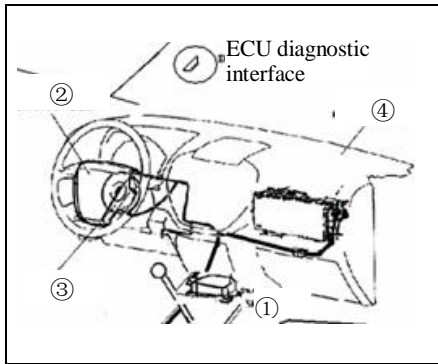
- 1) Removal of radiator fan (see diagram)
Disconnect connection of radiator fan electrical connector and engine compartment wiring harness;
Use wrench to remove 4 installation screws of radiator fan, and remove radiator fan by pulling it upward.
- 2) Installation of radiator fan
Install radiator fan on radiator, and tighten installation screw;
Connect radiator fan electrical connector to engine compartment wiring harness.

Maintenance of air bag

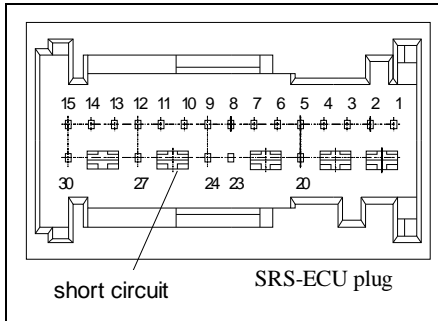
1 Precautions of maintenance

For safety purposes, the following precautions must be read before operation is commenced.

- (1) SRS air bag service should be made in the sequence as given in this Chapter and the following precautions must be observed.
- (2) Use equipment specified in this manual.
- (3) The following parts must be replaced in maintenance, as shown in diagram.

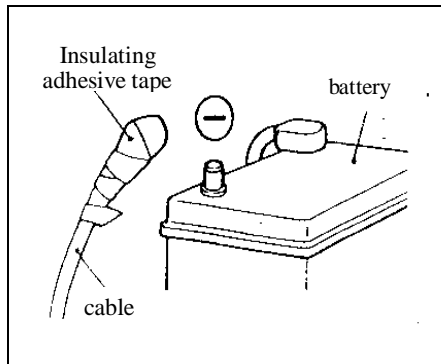


- ① SRS air bag control element (SRS-ECU)
- ② Driver side air bag module
- ③ Clock spring module
- ④ Passenger side air bag module



- (4) Faulty SRS air bag wiring harness must be replaced, as shown in diagram. Faulty wiring harness can be repaired or replaced as per requirement given Table below.

No	Name	Description	Remedy	Input/output
5	IGN	Battery voltage	Repair or replace	I
6	GND	Ground-bonding wire	instrument panel or air bag wiring harness	I
7	WL	Air bag warning lamp	Repair or replace instrument panel or air bag wiring harness	O
9	K	Diagnosis series data I/O (K line)		I, O
10	DAB Hi	Driver side front air bag, high end	Repair or replace floor wiring harness	O
11	DAB Lo	Driver side front air bag, low end		O
13	PAB Hi	Passenger side front air bag, high end	Repair or replace floor wiring harness	O
14	PAB Lo	Passenger side front air bag, low end		O
30	Crashout	Crash output (door lock unlocks automatically after crash)	Repair or replace floor wiring harness	O



- (5) Before maintenance, negative pole connection of battery must be disconnected and wait for 60 seconds. Make sure to wrap the negative cable disconnected with insulating adhesive tape, as shown in the diagram.

After the battery is disconnected, the capacitor in SRS-ECU will maintain certain level of capacity into to guarantee deployment of air bag within a given period of time. If maintenance work is to be done after waiting for some time, the air bag might be deployed accidentally and hurt the operator.

- (6) If painting is to be carried out, it is better to remove SRS-ECU, air bag module, clock spring and some other parts that might be affected by high temperature.

! Remove SRS-ECU, air bag module and clock spring when temperature is above 93℃.

- (7) After SRS air bag system is serviced, use diagnosis scanner to clear all fault codes, so as to make warning lamp work normally.

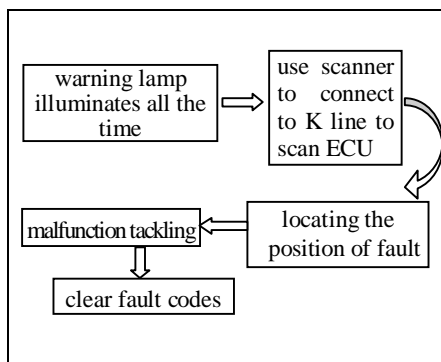
2 Special tools

- (1) Test instrument (as show in diagram)



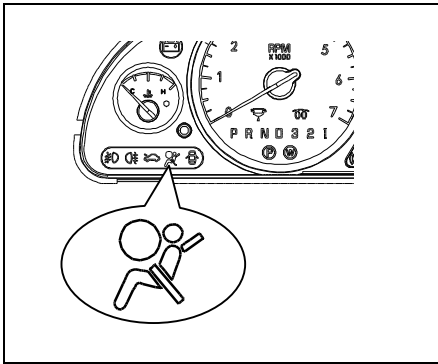
Name: diagnosis tester ((X-431 analyzer)

Purpose: check system fault of SRS air bag system, and clear ECU fault code



3 Malfunction tackling

- (1) Basic flow of fault diagnosis is as shown in the diagram below.



Inspection of SRS air bag warning lamp (see diagram)

- ① Put ignition switch at ON position, and make sure SRS warning lamp comes on.
- ② After coming on/goes off for 6 times, and make sure warning lamp remains off.
- ③ Make further diagnosis check.

(2) System diagnosis

HAE2.5 will carry out a series of diagnosis tests to check the function of the air bag system. These tests will prevent restraint system from detonating accidentally and guarantee detonation at crash. If trouble is found, HAE2.5 will store a suitable fault code and illuminate warning lamp to indicate the state of the fault for convenience of maintenance.

(3) Parameters

- ① Battery output voltage

Miniature controller monitors battery input voltage V_{bat} to if it is within the range given in the following Table.

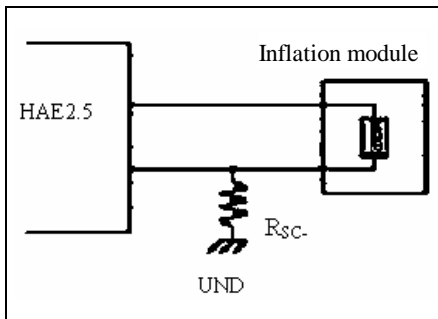
Battery output voltage range test:

Battery output voltage	Description	Fault indication
$V_{batt} \leq 7.2V$	Battery voltage is too low	Fault is found
$9V \leq V_{batt} \leq 16V$	Normal	No fault
$V_{batt} \geq 19.2V$	Battery voltage is too high	Fault is found
$7.2V < V_{batt} < 9V$ $16V < V_{batt} < 19.2V$	Tolerance	Not sure if there is fault

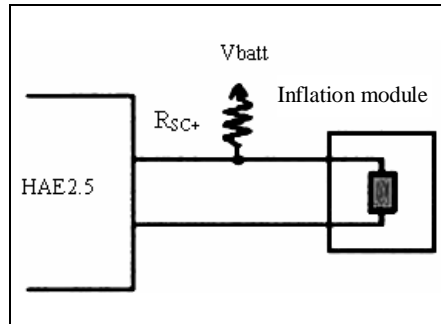
- ② Ignition circuit is shorted to ground

Miniature controller monitors ignition circuit and make sure if a circuit shorted is to ground at impedance lower enough to cause unnecessary detonation of ignition circuit or conflict against measurement of squib resistance. The following table describes in detail the detection of being shorted to ground.

Inspection of being shorted to ground:



Short circuit resistance	Description	Fault indication
$R_{sc-} < 1 K\Omega$	Shorted to ground	Fault is found
$R_{sc-} > 12 K\Omega$	Normal	No fault
$1 K\Omega \leq R_{sc-} \leq 12 K\Omega$	Tolerance	Not sure if there is fault



③ Ignition circuit is shorted to battery

Miniature controller monitors ignition circuit and make sure if a circuit shorted is to battery at impedance lower enough to cause unnecessary detonation of ignition circuit or conflict against measurement of squib resistance. The following table describes in detail the detection of being shorted to battery.

Inspection of circuit being shorted to battery:

Short circuit resistance	Description	Fault indication
$R_{sc+} < 1\text{ K}\Omega$	Shorted to battery	Fault is found
$R_{sc+} > 12\text{ K}\Omega$	Normal	No fault
$1\text{ K}\Omega \leq R_{sc+} \leq 12\text{ K}\Omega$	Tolerance	Not sure if there is fault

④ Driver front air bag ignition circuit resistance

Miniature controller can detect resistance (RDAB) of all ignition circuits of driver front air bag. See following equation:

$$RDAB = RS + RT + RW + RC$$

Where: RS = squib resistance

RT = connector resistance

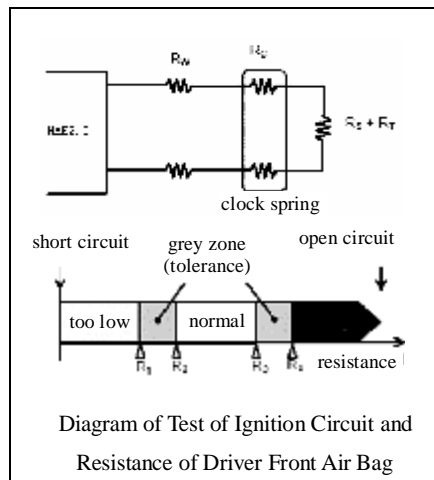
RW = wiring harness resistance

RC = clock spring resistance (not included in passenger air bag)

The test of these resistances is defined in the following Table.

Driver front air bag ignition circuit resistance is in unit of Ω .

Resistance range	Description	Fault indication
$RDAB \leq 1.06$	Resistance is too low	Fault can be displayed
$1.80 \leq RDAB \leq 4.40$	Normal	No fault
$RDAB \geq 6.60$	Resistance is too high (open circuit)	Fault can be displayed
$1.06 < RDAB < 1.80$ $3.60 < RDAB < 6.60$	Tolerance	Fault display is not confirmed



⑤ Passenger side front air bag ignition circuit resistance

Miniature controller can detect resistance (RPAB) of all ignition circuits of passenger air bag. See following equation:

$$RPAB = RS + RT + RW$$

Where: RS = squib resistance

RT = connector resistance

RW = wiring harness resistance

Check passenger side front air bag ignition circuit resistance (in Ω)

Resistance range	Description	Fault indication
$RPAB \leq 0.8$	Resistance is too low	Fault can be displayed
$1.70 \leq RPAB \leq 3.60$	Normal	No fault
$RPAB \geq 5.6$	Resistance is too high (open circuit)	Fault can be displayed
$0.80 < RPAB < 1.70$ $3.60 < RPAB < 5.60$	Tolerance	Fault display is not confirmed

⑥ Warning lamp circuit

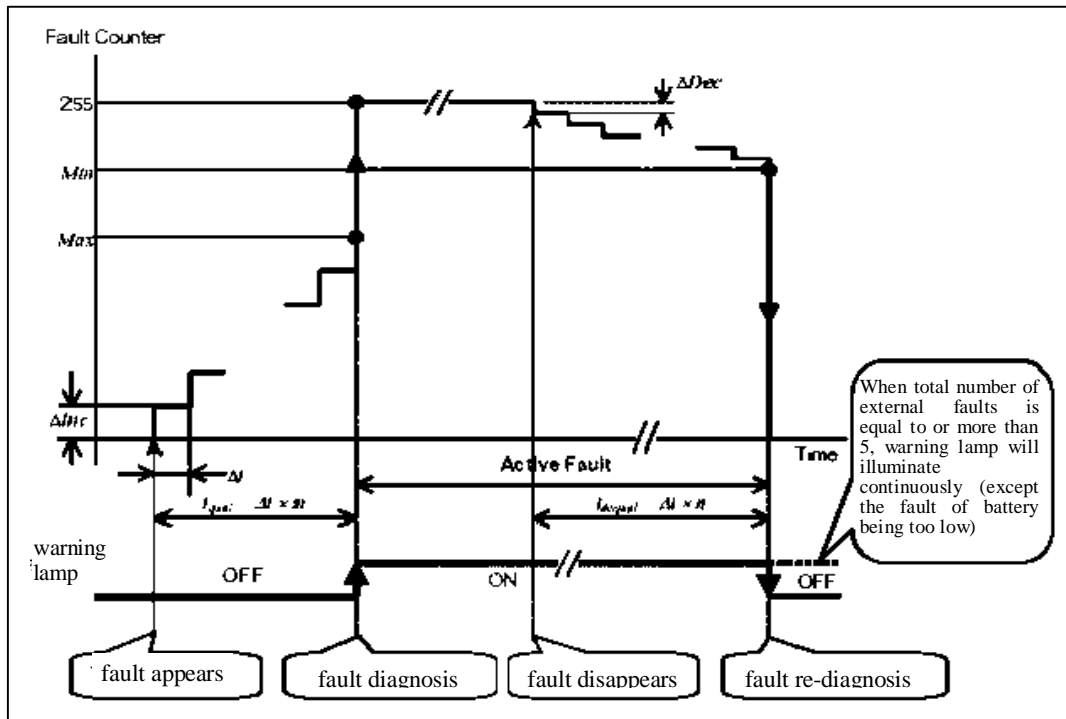
Miniature controller can detect the voltage of warning lamp output pins to determine if the state of lamp conforms to the state of command (refer to Table below).

Check warning lamp circuit

Lamp state	Warning lamp voltage	Description	Fault indication
On	$VWL \leq 3.5V$	Normal	Fault is not displayed
	$VWL \geq 4.5V$	To Vbatt or is open	Fault can be displayed
	$3.5V < VWL < 4.5V$	Tolerance	Fault display is not confirmed
Off	$VWL \geq 0.8 \times V_{batt}$	Normal	Fault is not displayed
	$VWL \leq 0.4 \times V_{batt}$	Grounded or shorted	Fault can be displayed
	$0.4 \times V_{batt} < VWL < 0.8 \times V_{batt}$	Tolerance	Fault display is not confirmed

(4) Malfunction tackling

Remedy (external faults)



① Fault diagnosis

In system diagnosis, if the number of faults detected by X-431 in succession reaches the predefined value, X-431 will give "Fault appears" as a detection result. The corresponding fault code will be stored in EEPROM, and illuminate warning lamp at the same time.

The following is the diagnosis time of several types of faults

Type of Fault	Common fault	internal fault	voltage is too high/low
Fault counter increment (ΔInc)	8	8	4
Maximum counter (Max)	40	40	160
Number of fault occurrence (m)	5	5	40
Time of diagnosis process (Δt)	400 ms	400 ms	400 ms
Fault diagnosis time ($t_{dequal} = \Delta t \times m$)	2 sec	2 sec	16 sec

② Fault re-diagnosis

When fault disappears, it means that there is no fault existing in the diagnosis cycle. Fault will be re-determined, warning lamp distinguishes. Then, fault counter returns to “0”, and fault state will be recorded in EEPROM, “Fault appear” will be changed to “Historical fault”.

Diagnosis time, fault re-diagnosis time, etc. are defined in specified types of faults

Some exceptions of fault re-diagnosis:

- Exception 1) Fault diagnosis of “internal fault” is the same as that of common faults. However, if fault re-diagnosis does not run, SRS-ECU should be replaced.
- Exception 2) usually, in external fault re-diagnosis, warning lamp goes off. However, if the total number of fault occurrence is equal to or greater than 5次, warning lamp will illuminate continuously even though fault disappears. In calculating the total number of fault occurrences, fault of “voltage too low” will not be taken into account.

Re-diagnosis time of several types of faults is listed in the Table below:

Type of Fault	Common fault	Voltage is too high/low
Fault counter counts down (ΔDec)	1	1
Minimum counter (Min)	$255 - 25 = 230$	$255 - 25 = 230$
Number of fault cancellations (n)	25	25
Time diagnosis process (Δt)	400 ms	400 ms
Fault re-diagnosis time ($t_{dequal} = \Delta t \times n$)	10 sec	10 sec

General description of fault diagnosis and re-diagnosis time

Fault diagnosis and re-diagnosis time

Type of Fault	Fault diagnosis time	Fault re-diagnosis time
External fault	2 sec	10 sec
Internal fault	2 sec	(Fault re-diagnosis does not begin)
Voltage is too low or too high	16 sec	10 sec

③ Clear fault codes

When ECU receives “clear fault code” from diagnostic tester (Hi-DSTM) via serial interface, fault code in ECU will be cleared. However, if an internal fault code is recorded or a crash is recorded, it will not execute this clear command.

4 Precautions on maintenance of SRS air bag control element (SRS-ECU) , SRS air bag module and clock spring

Caution:

Begin maintenance work after removing battery (—) negative pole, and wait for 60s. Wrap the removed (—) negative cable

Never disassemble or repair SRS-ECU. In case of failure, replace it with a new one.

Do not shock or vibrate SRS-ECU. Replace it if dents, cracks or deformation are found.

Once air bag is deployed, replace a new SRS-ECU.

- (1) As for removal and installation of SRS-ECU, refer to the following diagram.

Preparation for removal:

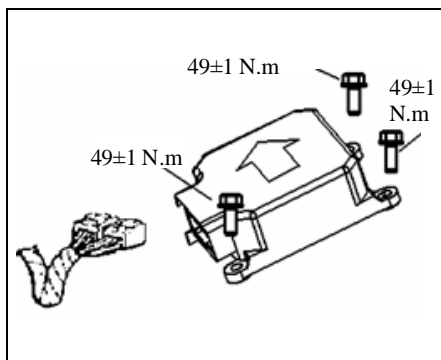
- ① Put ignition switch at OFF position.
- ② Disconnect battery (—) negative pole cable. Place at a suitable position or wrap it properly with adhesive tape.

Sequence of removal:

- ① Remove central passage cover plate and its relevant parts at lower end of the instrument panel.
- ② Remove connector connected to air bag ECU.
- ③ Remove air bag ECU
- ④ Place ECU at its storage position.

Sequence of installation:

- ① Check if there is foreign objects on ECU bracket and bracket is flat;
- ② Install ECU;
- ③ Plug in air bag ECU connector;
- ④ Install central passage cover plate or and its relevant parts at lower end of the instrument panel.



- (2) Removal and installation of driver side air bag module (DAB)

Preparation for removal:

- ① With steering wheel and front wheel set at straight forward running direction, take out ignition switch key.
- ② Remove connection of battery (—) negative pole.

Sequence of removal:

- ① Loosen screws on both sides of DAB module;
- ② Remove DAB module from steering wheel body, and gently unplug generator connector and horn connector;
- ③ Loosen steering wheel fixing nut, remove steering wheel, and pull out wiring harness of clock spring from the hole above the steering wheel,
- ④ Place steering wheel and DAB module at a suitable position.

Sequence of installation:

- ① Check before installation;
- ② Remove locating pin of clock spring;
- ③ Insert wiring harness of clock spring into the hole above steering wheel, place steering wheel spline sleeve into steering wheel column, and tighten lock nut;
- ④ Connect generator connector and horn connector;
- ⑤ Place DAB module into steering wheel body, and adjust its state properly.

(3) Removal and installation of passenger side air bag module (PAB)

Sequence of removal:

- ① Open storage box;
- ② Locate PAB module and air bag wiring harness connector, and unplug it;
- ③ Loosen installation bolts of PAB module and automobile body cross beam bracket;
- ④ Use tool to separate trim cover from instrument panel;
- ⑤ Take out PAB module, and place it at a suitable location.

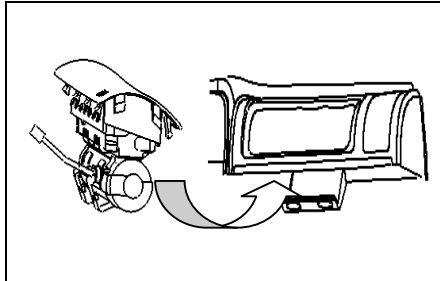
Caution:

As trim cover and instrument panel are joined by means of hooks, when removing PAB module, care should be taken to prevent damaging the instrument panel;

Before installing steering wheel, do not pull out the locating pin on the clock spring.

Sequence of installation

- ① Open storage, place PAB module through the opening in instrument panel, as shown in the diagram;
- ② Tighten installation bolts of PAB module and automobile body cross beam bracket;
- ③ Locate PAB module and air bag wiring harness connector, and connect it;
- ④ Check if trim cover and instrument panel are well fit;
- ⑤ Re-snap on storage box.



(4) Removal and installation of clock spring

Sequence of removal:

- ① Remove DAB module, unplug wiring harness connector;
- ② Open multi-function switch housing;
- ③ Locate and disconnect wiring harness at connector lower end;
- ④ Remove clock spring;
- ⑤ Place clock spring at a proper position;

Sequence of installation:

- ① Check before installation;
- ② Install clock spring on clock spring mounting plate;
- ③ Connect the connector of air bag wiring harness and horn;
- ④ Install multi-function switch housing
- ⑤ Check after installation.